

**DRAFT  
RANGE USE HISTORY REPORT**

**FOR THE  
CAMP EDWARDS IMPACT AREA  
GROUNDWATER QUALITY STUDY**

**MASSACHUSETTS MILITARY RESERVATION  
CAPE COD, MASSACHUSETTS**

**Prepared for**

**NATIONAL GUARD BUREAU  
ARLINGTON, VIRGINIA**

**Prepared by**

**OGDEN ENVIRONMENTAL AND ENERGY SERVICES  
239 Littleton Road, Suite 1B  
Westford, Massachusetts 01886**



07/16/97

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## DISCLAIMER:

This document has been prepared pursuant to a government administrative order (U.S. EPA Region I SDWA Docket No. I-97-1019) and is subject to approval by the U.S. Environmental Protection Agency. The opinions, findings, and conclusions expressed are those of the authors and not necessarily those of the U.S. Environmental Protection Agency.



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## 1. INTRODUCTION

In July 1996, the National Guard Bureau (NGB) and the Massachusetts Army National Guard (MAARNG) were directed by the Deputy Undersecretary of Defense for Environmental Security (DUSD(ES)) to study the effects of military operations on the groundwater beneath the Impact Area at the Massachusetts Military Reservation (MMR). An Action Plan for the study has been prepared and revised in consultation with the U.S. Environmental Protection Agency Region I and other agencies. The objective of this study is to determine whether the activities at the training range and Impact Area at Camp Edwards, which is the Army portion of MMR, have affected, or will affect, groundwater quality. The first task in this study is a search of the MMR archives and records to document the historical use of the Impact Area. The study is in partial fulfillment of the requirements of EPA Administrative Order SDWA I-97-1019.

This document presents the results of research into the historical use of the Impact Area. The research consists of inspection of documents held at the MMR and information provided to EPA by NGB, now in a public information repository contained at the Falmouth Public Library and at other area libraries. The most important of these documents are Standard Operating Procedures for the Firing Ranges that were updated periodically over the last 50 years. Interviews with individuals that had experience with the Range and Impact Area have also been conducted and efforts to identify further candidates for interview have been made. Summaries of the interviews that have been completed are included. The available records on the munitions used in the Impact Area are presented and summarized. Finally, information on hazardous waste handling and disposal practices are summarized.

This document is prepared with the archive information that is available as well as interviews with individuals who have historic perspective on base operations. The state of record keeping at MMR is such that limited historic documentation was available. The incomplete historical record is driven by US Army requirements that most records (e.g., rate of munitions use) be retained for only a few years. The situation is exacerbated by the changes in the management of MMR from the US Army to the MA Army National Guard (MAARNG).

This document will report on four topics:

- The location and intended use of different range areas including historical configurations and uses;
- Personal recollections of range activities including firing, waste disposal, etc.;
- The level of weapons use at the facility, broken down by time period and by range, to the extent possible; and
- Current practice on hazardous waste handling and disposal.

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The degree to which each of these topics is defined varies. A variety of information was available on the location and use of former range areas. Thus, the location of a number of activities within the Range Area that were not described in the Action Plan are identified. In particular, a number of abandoned firing ranges are described. On the other hand, it has not been possible to completely define either the historical rate of weapons use or historic hazardous waste handling practices.

One of the most productive means of identifying historical range uses has been interviewing individuals that have had access to the range in the past. While several interviews have been performed, more are planned and some individuals that have been interviewed will be asked to tour the Impact Area to help identify specific features and historical activities. This document consists of several tables and maps that identify locations and the activities that took place there. Some of these maps and tables will be reissued along with summaries of the additional interviews and site reconnaissance tours.

A companion report presents the chemical constituents of munitions known to be used at the post. This will include a summary of the munitions likely to be used in each weapon, sketches and dimensions of the munitions (to the extent available); a listing of the chemical composition, and a summary of the most common chemical constituents. Another companion report will be prepared on a literature review of the fate and transport of these chemicals in the environment including summary of other studies of potential range impacts. Together, these three reports will provide the background for the field assessment of the potential effects of military operations on the groundwater beneath the Impact Area.

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## 2. MATERIALS AND METHODS

The records search consisted of the identification of the sources of data through a review of reports, databases, personnel interviews, and internal files of the MAARNG. All these sources were searched for information relating to the development and historical use of the ranges in the context of the practices that may affect the environment. The information gathered was reviewed in an effort to reconstruct the development of each range, its use pattern over the years, and the possible environmental consequences.

The primary sources of information for this review were historical range rule and regulations reports, the standard operating procedures for the ranges, personnel interviews, and the U. S. Department of the Army reports and training manuals relative to the manufacture, use and handling practices over the years. Additional interviews are also planned and summaries of those will be provided in addenda to this document.

Air Space Utilization reports are among the information provided by NGB to the EPA, and are currently located in the Falmouth library and other public information repositories (see Table 2-1). These records consist of a daily log of range activities, including the amounts of munitions fired from each range. Summaries of these reports were prepared for the period from 1993 to 1996 and were used in the preparation of Tables 4-3 and 4-4, below. These reports are also available for the period from 1987 to 1992, although the copies are not included in this document considering the large volume of records involved. Prior to 1987, little information is available on the specific quantities of munitions used in the Range. Under the US Army's record keeping system, there is a requirement to maintain such records for only one year (Telecommunication with Sergeant Marble, see Appendix A).

During the execution of this effort, discussion was had with staff at the MA National Guard Archive and Museum in Worcester, MA (Telecommunication with Stephen Seames, see Appendix A). In particular, an inquiry was made to see if this resource might contain information on either the rate of munitions use in the Range Area or data on the population of trainees at the post through time. The archive is relatively new and most of the records contained there have yet to be sorted. Archive staff stated that rate of munitions use would be unlikely to be stored there as munitions supply and the attending record keeping are federal functions. The Commonwealth of Massachusetts has responsibility for such things as personnel records etc. and only those items are likely to be in the archive. In addition, much of the activity at the post has been related to US Army operations in which the MAARNG would not have been directly involved. Archive staff did indicate that records of post usage may be available in the annual reports of the Adjutant General of MAARNG. Archive staff indicated that these documents are



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available in the MA State Library. In fact, an incomplete set of these documents is available at that location.

**Table 2-1. Availability of Monthly Air Space Utilization Reports**

<b>Year</b>	<b>Months for Which Records are Available</b>
1987	Oct, Nov
1988	Apr, Jul, Aug, Sep, Oct, Nov, Dec
1989	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec
1990	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec
1991	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec
1992	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec

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## 3. MMR HISTORY

The Massachusetts Military Reservation (MMR) was commissioned in 1911 as a training site for the New England States National Guard and law enforcement agencies. In 1940, the U.S. Army secured a 99 year lease on the reservation from the Commonwealth of Massachusetts (MAARNG, 1984). The site subsequently became a primary assembling and training facility for U.S. troops during World War II. For their training requirements, the MAARNG had built about seven ranges between 1935 and 1940. These ranges were generally located to the north and parallel to the North Outer Road with the arms of the ranges oriented Northeast and Northwest to the boundaries of the reservation.

Subsequent to the 1940 lease, and in preparation for World War II, the Department of the Army embarked on a facilities construction program to accommodate the troops being trained for World War II. At the end of this program, Camp Edwards had about nineteen ranges and two anti-aircraft ranges (SOP, 1953, 1941 map of the training range - Map 1: Appendix B). After the war, and in response to the Cold War, the Army continued to improve and add to the training facilities at Camp Edwards until 1953. From 1954 to 1973, the U.S. Army oversaw a reduction in activities at Camp Edwards, which was now reduced to supporting army reserve training. The only improvement at MMR during this period was the addition of a military airfield (Otis Air Force Base) and its supporting facilities by the Department of the Air Force. In 1974 the Air Force and Army moved their operations from MMR turning over their leased areas to Massachusetts Air National Guard and MAARNG, respectively.

Over the next several years (1974 to 1984), the activities at MMR were gradually reduced to the current levels of a military complex with no single agency responsible for all the activities conducted there. The biggest tenant is the MAARNG that operates and maintains the ranges and Impact Areas. The current training facilities maintained include 20 firing ranges, 19 gun positions, 9 observation posts, and 9 mortar positions (two inactive) as listed in Table 3-1. The locations of these ranges and firing points are shown on Map 2, Appendix B.

More information regarding the location and historical uses of these various range positions is provided below in Section 4.0.

Efforts were made to establish the population of trainees at MMR through time. While general population trends are clear, specific data for each year are not available. It is clear that Camp Edwards, and the training range, were very active during the war years. During World War II, the post population was 30,000 and it is likely that this population was dominated by trainees who were at the post for a relatively short period of time and then were replaced by new trainees. This is confirmed by reports that the ranges areas were active 24 hours a day.

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On the other hand, the rate of training in recent years is likely to be much lower as it is restricted to the needs of MAARNG and state law enforcement officers.

The rate of use during other periods (i.e., Korean and Vietnam Wars, non-war periods under US Army Control) are uncertain but are likely to be intermediate between World War II and recent years based on base populations and training needs.

**Table 3-1. Current Range Use of Camp Edwards**

1. Ranges

Range	Firing Points	Description
A	4	Machine gun Familiarization only .50 caliber
B-C	55	1000" M16 Rifle Zero/Qualification
D-E	55	1000" M16 Rifle Zero/Qualification
E	27	Rifle/Machine gun Familiarization, Zero/Qualification
G	5	Shotgun Familiarization Range
H	25	25 meter MG
I	8	M203/M79 Grenade Launcher Familiarization Course
J	18	Pistol
J-3		Textron Research
K	26	Pistol Familiarization, Qualification Range
	1	3.5" Rocket
L	1	SQD/PLT Attack Course
M		Not Used
N	55	25 meter M16 Rifle
O	10	Machine gun Field Fire (M50)
P	26	Pistol
Q		Unknown
S (S-E, S-W)	5	3.5" Rocket Launcher & LAW Familiarization Course
U	6	LAW
KD	1	14.5 Sub Caliber. Device FA Trainer Range/ mortar Range
	15	200, 300, 500 Yard Range

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**Table 3-1. Current Use of Camp Edwards  
(Continued)**

**2. Mortar positions**

Mortar Position	Firing Points	Description
MP1	1 mortar Unit	4.2" & 81 mm mortar position
MP2	1 mortar Unit	4.2" & 81 mm mortar position
MP3	1 mortar Unit	4.2" & 81 mm Track Mounted mortar position
MP4	1 mortar Unit	4.2" & 81 mm mortar position
MP5	1 mortar Unit	4.2" & 81 mm mortar position
MP6	1 mortar Unit	4.2" & 81 mm mortar position
MP7	1 mortar Unit	81 mm mortar position
MP8		Inactive
MP9		Inactive
GP16	1 mortar Unit	4.2" mortar position
O Range	1 mortar Unit	81 mm mortar position (IBC support only)

**3. Gun Positions**

Gun Position	Firing Points	Description
GP2	6 Tube	105/155 mm Firing position (emergency fire mission only)
GP4	6 Tube	105/155 mm Firing position
GP5	6 Tube	105/155 mm Firing position
GP6	6 Tube	105/155 mm Firing position
GP7	6 Tube	105/155 mm Firing position
GP8	6 Tube	105/155 mm Firing position
GP9	6 Tube	105/155 mm Firing position
GP10	6 Tube	105/155 mm Firing position
GP11	6 Tube	105/155 mm Firing position
GP12	6 Tube	105/155 mm Firing position
GP14	6 Tube	105/155 mm Firing position
GP16	6 Tube	105/155 mm Firing position
GP17	6 Tube	105/155 mm Firing position
GP18	6 Tube	105/155 mm Firing position
GP20	6 Tube	105/155 mm Firing position
GP22	6 Tube	105/155 mm Firing position
GP24	6 Tube	105/155 mm Firing position



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**Table 3-1. Current Use of Camp Edwards  
(Continued)**

**4. Observation Posts**

OP1	No Building
OP2	No Building
OP3	Tower
OP4	Tower
OP5	Tower
OP6	Cement Bunker
OP7	Tower
OP8	Cement Bunker
OP9	Tower
MP5	Tower

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## 4. HISTORICAL USE OF THE RANGES

This section will discuss a number of topics related to historical uses of the Impact Area. The general goals of this effort are: (1) the identification of activities that have occurred within the Impact Area that might affect groundwater quality; (2) definition of the location(s) of those activities; and (3) estimation of the quantities of material (especially munitions) used in the activities. As discussed above, review of historical documents and interviews with individuals with historic access to the Impact Area were used to identify historic activities within the Impact Area and its environs. This information is used to construct a set of tables that outline the locations, provide each with a unique designation, and briefly describe the activities known to have occurred there. The types of locations include: (1) constructed facilities (e.g., firing ranges); (2) target areas; (3) locations of activities (e.g., application of defoliants); and (4) features that were discernible on historical aerial photos. For firing ranges and some other Impact Area locations, individual tables are provided describing the type of historical activities known to have occurred there.

The following section presents information on constructed range facilities (e.g., firing ranges). A discussion of the quantities of munitions used is provided in Section 4.2. The chemical composition of the munitions is described in an accompanying report. Other range activities (contractor ranges, areas apparent from aerial photos, and hazardous material handling) are discussed in Section 4.3. A complete summary of those known locations with the potential to have environmental impact are presented as a table to support Map 8 in Appendix B. This table presents a brief summary of the activities at a given location and provides a unique number for that location. The unique number is annotated on Map 8.

### 4.1 Types of Ranges

The historical use of the ranges at Camp Edwards has been predicated by the need to maximize their usability with respect to the readiness of the military and/or law enforcement forces to meet the challenges of their duty. Therefore, the use patterns of the ranges over the years have varied to satisfy that need. Five distinct types of activities have been used to assign use patterns to the ranges at Camp Edwards since 1911. Some ranges and observation positions have been used for more than one activity, and are classified under the miscellaneous category. The types of ranges include:

#### i) Firing Ranges

Weapons used at these ranges vary from handguns to rifles to machine guns to rocket launchers. The primary components of these ranges include a clear range area that is reasonably level, a raised firing point, targets, target communications and protected access between the target and firing point and target repair and range control facility.

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Beyond the target locations, a berm is generally constructed of earth to act as the collection point of spent munitions.

## ii) Artillery Ranges

Artillery ranges normally cover a large area to provide the gun positions, observation towers and an Impact Area. The maximum range for artillery purposes have been as long as 21,000 feet depending on the weapon. A common Impact Area has been used for all artillery ranges. Observation points and towers are scattered over a wide area all over the range area to facilitate their use to cover as many artillery and mortar ranges as possible. A typical artillery position will consist of a clearing for the guns and a concrete shelter (bunker) for the personnel.

## iii) Mortar Ranges

Mortar ranges are similar to artillery ranges except that the mortars require shorter ranges than artillery. Thus, less clearing is necessary for observation of the firing effects relative to the gun position.

## iv) Anti-Aircraft Ranges

Historically, there have been anti-aircraft weapons fired at Camp Edwards, but most of this activity was in was in World War II and immediately thereafter.

## v) Miscellaneous Ranges

Certain observation points and the O Range have been used in the past as temporary gun positions (SOP 1983). In addition, the contractors AVCO and Textron are known to have had handled warheads and other smaller munitions for experimental testing purposes on Range J-3. Other ranges were used under contract to the Department of Defense by Hesse Eastern and Atlantic Research. The type of activities that occurred under these two contractors is not known. There are also two known demolition areas where unexploded ordnances found at MMR are detonated. Other miscellaneous ranges include a Mock Village identified on maps from the 1940s and 1950s and historical anti-tank ranges.

## 4.2 History of Individual Ranges

Due to the varied demand for troop readiness and the availability of training equipment, the ranges have undergone numerous improvements over the years to the current status. The following is brief discussion of the ranges and the changes they have undergone over the years based on SOPs and range regulations contained in the MMR archives.

A number of ranges have been used at MMR over the years. Some ranges have been abandoned and others have been renamed. In fact, more than one range has borne certain range designations



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(e.g., Range A) through time. In response to these issues, Table 4-1 was constructed with a complete list of all known firing ranges. Each range is given a unique “name” that will be used in this document. Names of currently active ranges have been retained and are used to describe historical activities that might have occurred at that location under a different name. Abandoned ranges are described as “inactive”, if its name is unique, or as “Old” if the name overlaps with a currently-active range. Table 4-1 provides the name of the range, any historical names that might have applied, and a short description of the function and location of the range.

Table 4-1 is supplemented by a number of appendices that provide more extensive historical information. Appendix C consists of individual tables for each range that describe: (1) the current range designation; (2) any former designations including the date(s) of change; (3) a narrative location; (4) a location based on site coordinates; (5) a reference to any available sketches or photos (provided in Appendix D); (6) a description of the basic function (e.g., practice range); (7) a reference number to Map 8 of Appendix B; and (8) a list of known historical activities (e.g., specific weapons fired). The last data are supplemented by the known dates of the activity as well as the source of the information. Data sources include Range Standard Operating Procedures, other documents, and the interviews presented in Section 5, below. Thus, Appendix C is a summary of the known historical activities at each firing range location. It should be noted that it is not clear that a complete set of Range SOPs was available in the archives.

Table 4-2 is a summary of the known historical mortar and gun positions. Appendix E contains summary tables for the mortar and gun positions. In addition, a separate table is provided for the known target locations for mortars and howitzers. These locations are available from one of the Range SOPs. Appendix F provides the range fans for the active gun and mortar positions. Note that these fans were developed to include the target areas of the relevant mortar and gun positions. It is possible that munitions could fall outside of these fans. For example, a “short-round” may not reach the near edge of the fan as defined in Appendix F.

Appendix B contains maps which depict many of the historical changes in the ranges including:

- a sketch by CT Main, the range developer, summarizing construction in 1941 (Map 1);
- the current (1994) map showing ranges and training areas (Map 2);
- a 1949 map that shows ranges and training areas (Map 3);
- a 1949 map showing ranges and range fans (Map 4);
- a 1979 topographic of Camp Edwards without annotation of training ranges etc. (Map 5);
- a 1986 Special Map of Camp Edwards with annotation of training ranges, etc. (Map 6);
- a 1991 map summarizing training areas (e.g., bivouac locations) in the Training Range (Map 7); and
- a markup of a recent base map of the training range combining features of several maps as well as information from other data sources (Map 8). A key in the form of a table is attached to this map.

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**Table 4-1**  
**Historical Range Locations**

Range Name	Old Designation	Function	Location
A		Practice Range	Burgoyne Rd.
B		Practice Range	Burgoyne Rd.
C		Practice Range	Burgoyne Rd.
D		Practice Range	Burgoyne Rd.
Demo 1	E-1, E-2	Demolition Range	Pocasset-Forestdale Rd.
Demo 2	E-3	Demolition Range	off Gibbs Rd.
E		Combat Pistol Qualification	Burgoyne Rd.
G	E	Practice Range	Pocasset-Forestdale Rd.
H	E, E-1	Practice Range	Pocasset-Forestdale Rd.
I	F	Practice Range	Pocasset-Forestdale Rd.
IBC		Infantry Battle Course	Gibbs Rd.
J		Practice Range	Pocasset-Forestdale Rd.
K	M	Practice Range	Pocasset-Forestdale Rd.
KD		Multi-purpose Range	Pocasset-Forestdale Rd.
CTR-1/M31		Practice Range	Pocasset-Forestdale Rd.
L	I	Practice Range	Greenway Rd.
N	J-2	Practice Range	Greenway Rd.
O	G	Practice Range	Greenway Rd.
P	K	Practice Range	Greenway Rd.
S-EAST		Transition Range	Gibbs Rd.
S-WEST		Transition Range	Gibbs Rd.
T	P	Practice Range	Gibbs Rd.
U	S	Rocket Launcher	Gibbs Rd.
J-3		Test Range	Greenway Rd.
J-1-inactive		Practice Range	Greenway Rd.
M-inactive		Practice Range	Greenway Rd.
Q-inactive		Practice Range	Gibbs Rd.
R-inactive	L	Practice Range	Gibbs Rd.
MT-inactive		Practice Range	Greenway Rd.
Mus-2-inactive		Practice Range	Greenway Rd.
MV-inactive		Mock Village	Greenway Rd.
Old-A		Anti Tank Gravity Range	Woods Rd.
Old-B		Practice Range	Frank Perkins Rd.
Old-C		Practice Range	Frank Perkins Rd.
Old-D		Practice Range	Frank Perkins Rd.
G-A/G-B-inactive		Practice Range	north side of Dolan Rd.
GN-1-inactive		Grenade Range	Howe Rd., junction Frank Perkins Rd.
GN-2-inactive		Grenade Range	Howe Rd., junction Frank Perkins Rd.
Old-H		Practice Range	Greenway Rd., adjacent to I
Old-N		Practice Range	Gibbs Rd.
Old-O		Practice Range	Gibbs Rd.
Old-R		Practice Range	Gibbs Rd.

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**Table 4-2**  
**Historical Gun and Mortar Positions**

Name	Old Designation	Function	Location
GP-1-inactive		Gun Position	Stowell Rd.
GP-2		Gun Position	Frank Perkins Rd.
GP-3-inactive		Gun Position	Howe Rd.
GP-4-inactive		Gun Position	Howe Rd.
GP-5		Gun Position	Howe and Frank Perkins Rds.
GP-6		Gun Position	Mitton Rd.
GP-7		Gun Position	Mitton Rd.
GP-8		Gun Position	Mitton Rd.
GP-9		Gun Position	Howe Rd.
GP-10		Gun Position	Howe Rd.
GP-11		Gun Position	Howe Rd.
GP-12		Gun Position	Cataumet Rd.
GP-14		Gun Position	Jefferson Rd.
GP-15-inactive		Gun Position	Pocasset-Forestdale Rd.
GP-16		Gun Position	Jefferson Rd.
GP-17		Gun Position	Flatrock Rd.
GP-18		Gun Position	Flatrock Rd.
GP-19-inactive		Gun Position	Kendrick Rd.
GP-20		Gun Position	Off Cataumet Rd.
GP-22		Gun Position	Monument Swamp Rd.
GP-24		Gun Position	Wheelock Rd.
GP-2-old		Gun Position	South of Herbert Rd.
GP-3-old		Gun Position	South of Herbert Rd.
GP-4-old		Gun Position	North of Dolan Rd.
MP-1	MP-4	Mortar Point	Pocasset-Forestdale Rd.
MP-2		Mortar Point	Pocasset-Forestdale Rd.
MP-3		Mortar Point	Pocasset-Sandwich Rd.
MP-4	MP-1	Mortar Point	Pocasset-Sandwich Rd.
MP-5		Mortar Point	Pocasset-Sandwich Rd.
MP-6		Mortar Point	Pocasset-Sandwich Rd.
MP-7		Mortar Point	Pocasset-Sandwich Rd.
MP-8		Mortar Point	Off Pocasset-Sandwich Rd.
MP-9-inactive	MP-5	Mortar Point	Off Gibbs Rd.
MP/OP 1-inactive		Mortar Point	Off Pocasset-Sandwich Rd.
MP-2-old		Mortar Point	Off Monument Beach Rd.
MP-3-old		Mortar Point	Wood Rd.



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Other historical maps are available but are not provided in this document due to their poor reproducibility. These maps include:

- Pocasset, MA Topographic Quadrangle Map, 1943;
- Pocasset, MA Photographic Quadrangle Map, 1949;
- Pocasset, MA Topographic Quadrangle Map, 1953; and
- Pocasset, MA Topographic Quadrangle Map, 1979.

The maps that were not provided with this document all present surface features but are not annotated with training range locations such as firing ranges and gun positions.

In describing historical uses, the sources available may refer either to the weapons or munitions fired. Recent data on the munitions use provides information on the specific types of munitions (see Section 4.2). The accompanying document, the Chemical Composition of Munitions, describes data available on the content of recently fired munitions and discusses, in general terms, the likely changes in the content of related munitions through time. Based on the data available, it has not been possible to define the specific type of munitions used historically except as to the weapon used.

## 4.2.1 Firing Ranges

There are 42 separate locations that have been identified as firing ranges of some sort from 1941 to present. Nineteen of these locations are no longer in use. Of the 23 active ranges, two are demolition ranges and one is a DoD contractor test range. Four of the observation positions have been used for mortar firing in the recent past. One gun position (GP16) and the O-Range, have also been used for mortar firing. More information regarding the ranges is provided in Appendix C. Various historical maps provided in Appendix B indicate past locations of the mortar positions. A comprehensive definition of the range locations is provided on Map 8 of Appendix B.

## 4.2.2 Mortar and Gun Positions

The archive search was able to define 12 separate locations that at one time or another served as mortar positions. Five of these locations are no longer active. A total of 24 locations were identified that have served as gun positions. Eight of the gun positions are no longer active. More extensive information on the mortar and gun positions as well as the associated targets is provided in Appendix E. Map 8 of Appendix B provides approximate positions of all of these locations.

All artillery (gun) positions consist of 6 tube 105/155 mm howitzers. Due to the lack of information on these positions, and the fact that when available, the data has large discontinuities, it is assumed that most of the rounds used at these gun positions were HE rounds previous to 1985 when the use of HE rounds was discontinued. Also used with these rounds were Fuse Q, TI, and VT rounds. According to the range control and training office, several of the

# DRAFT RANGE USE HISTORY REPORT

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gun positions (at least seven) were phased out in the distant past. No records were found to verify the existence of GP-13, -21, or -23 as separate ranges.

Part of the operations involved in firing howitzers and mortars is placing an appropriate number of bags of propellant into the weapon. The number of bags used affects the distance the projectile travels. Such munitions are shipped with a complement of bags sufficient to fire all of the shells their full distance. If fewer bags are used because the target lies at less than the full distance, excess bags will remain when the shipment of shells is exhausted. It has been common practice to burn these excess bags at the point of use, the gun and mortar positions, usually on the ground behind the position or in a ditch along the side of the access road. Also, information from interviews (see Section 5.0) indicates that unfired ammunition was sometimes buried near a position if it could not be turned in to the Ammo Supply Point. Such buried munitions have been encountered during excavations near some positions.

## 4.3 Quantities of Munitions Within the Range Area

One of the goals of the archive search is the estimation of the density of munitions within the Impact Area and the firing ranges. In addition, there is a desire to understand the rate of high explosive failure (i.e., a low order round or "dud" that results in unexploded ordnance (UXO)). These estimates would be useful for understanding the strength of potential sources of contamination to groundwater. The density of spent munitions and UXO could be estimated if the historical rates of munitions use is available and the location(s) of deposition were known. Alternatively, data on the existing density of UXO found through field investigation could be used to estimate the prevalence of UXO at the site.

Each of the ranges described above can have several variations in use, all designed to suit the particular needs and types of weapons used for training. Table 4-3 is a summary of the existing rifle ranges showing the range, type of weapons fired, and the number of rounds fired in recent years. Table 4-4 contains the same information for the artillery and mortar ranges. These data are derived from summaries prepared by MAARNG and J.M. Montgomery (1991). When possible, the average rate of munitions use at the individual ranges is calculated. Table 4-5 contains the same information for the demolition ranges (J. M. Montgomery Engineers, 1991).

Tables 4-3 and 4-4 refer to weapons employed at each of the firing ranges as these are the data presented in the records available. For each weapon, there is likely to be a variety of available munitions (e.g., ball rounds, tracer rounds, etc.). The chemical composition of each of the various munitions will vary. The accompanying document to this one, the Chemical Composition of Munitions, presents available information on the chemical composition of the various munitions potentially used in the weapons known to have been employed at MMR. The Chemical Composition of Munitions report also presents the types of munitions that might be used for each weapon.

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**Table 4-3**  
**Rifle Range Utilization**

Range	Munition	Annual Quantity				
		1989	1994	1995	1996	MEAN
A RANGE	.50 CALIBER MG	37211	44430	16273	20094	29502
B RANGE	M16 RIFLE (5.56 MM)	26946	127578	155615	134052	111048
	9MM PISTOL	0	8316	350	1300	2492
C RANGE	M16 RIFLE (5.56 MM)	32335	192967	105855	110956	110528
	9 MM PISTOL	0	75	6845	21612	7133
	.45 CALIBER PISTOL	0	585	0	0	146
D RANGE	M60 MG (7.62 MM)	8423	36484	31556	32753	27304
E RANGE	.38 CALIBER PISTOL	10602	0	0	0	2651
	.45 CALIBER PISTOL	12564	11321	0	0	5971
	9 MM PISTOL	10150	71230	30345	7927	29913
	.357 CALIBER PISTOL	1000	0	0	0	250
	.30 CALIBER REVOLVER	0	3135	0	0	784
	.38 CALIBER REVOLVER	0	0	500		167
	.40 CALIBER PISTOL	0	2740	15500	11760	7500
	12 GAUGE SHOTGUN	0	400	0	0	100
G RANGE	M16 RIFLE (5.56 MM)	129343	33091	54312	6311	55764
	M60 MG (7.62 MM)	60648	18000	17444	22552	29661
	.45 CALIBER PISTOL	1050	0	1200	0	563
	.380 CALIBER PISTOL	0	1720	6530	5746	3499
	.40 CALIBER PISTOL	0	240	0	0	60
	.38 CALIBER PISTOL	19634	2213	0	0	5462
	9 MM PISTOL	12524	130275	166625	163821	118311
	12 GAUGE SHOTGUN	1565	1535	1425	1430	1489
H RANGE	M16 RIFLE (5.56 MM)	140595	26450	13348	3800	46048
	M60 MG (7.62 MM)	40423	23340	19941	18500	25551
	.38 CALIBER PISTOL	1900	0	0	0	475
	.45 CALIBER PISTOL	500	6100	0	0	1650
	9 MM PISTOL	4250	3500	850	1700	2575
	AK47 RIFLE (7.62 MM)	0	1100	0	0	275
I RANGE	12 GAUGE SHOTGUN	0	0	0	600	150
	M16 RIFLE (5.56 MM)	10778	55383	37754	60936	41213
	.40 CALIBER PISTOL	0	0	0	467	117
	.45 CALIBER PISTOL	5650	2750	0	0	2100
	.357 CALIBER PISTOL	0	1100	0	0	275
	.38 CALIBER PISTOL	0	13800	19750	13373	11731
	9 MM PISTOL	4683	77857	53500	85622	55416
	12 GAUGE SHOTGUN	555	4322	3980	8177	4259
J RANGE	.38 CALIBER PISTOL	106804	0	17600	1350	31439
	.380 CALIBER PISTOL	0	26642	0	0	6661



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**Table 4-3**  
**Rifle Range Utilization**

Range	Munition	Annual Quantity				MEAN
		1989	1994	1995	1996	
	.40 CALIBER PISTOL	0	20300	18500	28800	16900
	.45 CALIBER PISTOL	7995	500	560	10900	4989
	.30 CALIBER REVOLVER	0	28942	0	0	7236
	9 MM PISTOL	56865	20655	27366	31294	34045
	M16 RIFLE (5.56 MM)	0	11560	16694	21527	12445
	12 GAUGE SHOTGUN	4313	4055	1360	10383	5028
K RANGE	M16 RIFLE (5.56 MM)	17081	26369	23312	11360	19531
	.22 CALIBER PISTOL	0	7218	1200	0	2105
	.38 CALIBER PISTOL	169385	0	0	0	42346
	.380 CALIBER PISTOL	0	155	0	0	39
	.40 CALIBER PISTOL	0	135	0	39150	9821
	.45 CALIBER PISTOL	20944	25000	265	0	11552
	.35 CALIBER REVOLVER	0	930	0	0	233
	.38 CALIBER REVOLVER	0	7570	20900	18950	11855
	9 MM PISTOL	41600	26750	87845	40582	49194
	12 GAUGE SHOTGUN	8120	5185	1665	6780	5438
	.233 CALIBER AR 15	0	200	0	0	50
	9 MM SMG	0	8800	0	0	2200
	3030 RIFLE	0	300	0	0	75
KD RANGE	M16 RIFLE (5.56 MM)	22397	126772	111496	27611	72069
	M60 MG (7.62 MM)	33693	328	21042	0	13766
	40 MM CANNON	240	0	0	0	60
	90 MM	808	0	0	0	202
	.45 CALIBER PISTOL	5155	5080	0	0	2559
	.38 CALIBER PISTOL	0	0	550	1425	494
	M6 SIG (5.56 MM)	0	0	0	0	0
	.308 RIFLE	0	2650	0	0	663
	30-06 RIFLE	0	0	28	900	232
	.357 RIFLE	0	0	22	0	6
	9 MM UZI SMG	0	2800	0	0	700
	9 MM PISTOL	0	23626	350	0	5994
	M118 (7.62 MM)	0	409	80	20	127
	M31 (14.5 MM)	0	3361	0	0	840
	TOW	0	14	0	0	4
	12 GAUGE SHOTGUN	0	0	0	0	0
L RANGE	40 MM GRENADE LAUNCHER	14059	8972	3443	5099	7893
N RANGE	M16 RIFLE (5.56 MM)	48503	77438	35013	10696	42913
	.45 CALIBER PISTOL	5155	0	0	0	1289
	9 MM PISTOL	4030	0	0	4580	2153
	.357 PISTOL	16500	0	0	0	4125
	.380 PISTOL	0	0	0	0	0
	12 GAUGE SHOTGUN	1700	0	0	0	425
O RANGE	.45 CALIBER PISTOL	450	0	0	0	113



# DRAFT RANGE USE HISTORY REPORT

**Table 4-3**  
**Rifle Range Utilization**

Range	Munition	Annual Quantity				MEAN
		1989	1994	1995	1996	
	.40 CALIBER PISTOL	0	2190	8640	900	2933
	.38 CALIBER PISTOL	1560	0	0	0	390
	9 MM PISTOL	19920	53620	92350	66340	58058
	12 GAUGE SHOTGUN	4781	9542	8114	8077	7629
	.30 CALIBER REVOLVER	0	11075	0	0	2769
	.38 CALIBER REVOLVER	0	0	12375	11970	6086
	9MM SMG	0	11900	0	0	2975
	M60 RIFLE (7.62 MM)	0	600	0	0	150
	.223 RIFLE	0	0	0	5740	1435
P RANGE	.45 CALIBER PISTOL	32710	1000	0	0	8428
	.38 CALIBER PISTOL	18816	0	0	0	4704
	.380 CALIBER PISTOL	0	60	0	0	15
	.35 CALIBER REVOLVER	0	300	0	0	75
	.40 CALIBER REVOLVER	0	180	0	0	45
	9 MM PISTOL	10643	2480	13200	7817	8535
	.357 PISTOL	5100	0	0	8867	3492
	12 GAUGE SHOTGUN	3312	0	0	0	828
	M16 RIFLE (5.56 MM)	0	28340	23580	0	12980
S-E RANGE	M16 RIFLE (5.56 MM)	43114	34870	2340	3360	20921
	M60 MG (7.62 MM)	10108	88837	41608	84815	56342
	RIFLE (9 MM)	0	250	0	0	63
S-W RANGE	M16 RIFLE (5.56 MM)	0	12441	3220	0	3915
	M60 MG (7.62 MM)	0	45982	41250	45960	33298
U RANGE	LAW (TP)	2239	0	0	0	560
	AT4 (9 MM)	0	1654	2355	0	1002
	M190 LAW (35 MM)	0	38714	327	119	9790
IBC	M16 RIFLE (5.56 MM)	70066	9558	34308	37109	37760
	M60 MG (7.62 MM)	5055	12147	16140	7660	10251
	40MM (TP)	0	0	0	75	19
	9 MM PISTOL	0	259	0	0	65

Notes: MG Machine Gun  
MM Millimeter  
TP Training Practice Round  
LAW Light anti-tank weapon  
IBC Infantry Battle Course

# DRAFT RANGE USE HISTORY REPORT

**Table 4-4**  
**Artillery/Mortar Firing Point Utilization**

Position Name	Weapon System	Charge	Annual Quantity 1989
GP6	155 MM HOW	2	117
GP7	155 MM HOW	3	126
GP8	155 MM HOW	3	70
GP9	155 MM HOW	2	90
GP10	155 MM HOW	3	162
GP11	155 MM HOW	3	144
GP12	155 MM HOW	3	75
GP14	155 MM HOW	3	112
GP16	155 MM HOW	3	182
GP17	155 MM HOW	3	43
GP18	155 MM HOW	3	43
GP20	155 MM HOW	2	172
GP22	155 MM HOW	2	184
MP1	60 MM MORT	3	452
	81 MM MORT	3	713
MP2	60 MM MORT	3	186
	81 MM MORT	3	293
	107 MM MORT	8	704
MP3	60 MM MORT	4	346
	81 MM MORT	3	545
	107 MM MORT	8	375
MP4	60 MM MORT	4	452
	81 MM MORT	3	713
	107 MM MORT	8	725
MP5	60 MM MORT	4	106
	81 MM MORT	3	167
	107 MM MORT	8	196
MP6	60 MM MORT	4	372
	81 MM MORT	3	587
MP7	60 MM MORT	4	426
	81 MM MORT	3	671
MP8	60 MM MORT	4	324
	81 MM MORT	3	507

Notes:    HOW                      Howitzer  
             MORT                     Mortar

Charge refers to the number of propellant bags used in the weapon. More propellant bags enable the weapon to shoot farther.

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**Table 4-4**  
**Artillery/Mortar Firing Point Utilization**

Weapon System Impact Area Totals:	Annual Quantity			
	1994	1995	1996	MEAN
TOTAL 60 MM MORT HE	459	492	2098	1016
TOTAL 60 MM MORT IL	0	188	266	151
TOTAL 60 MM MORT WP	0	0	108	36
TOTAL 81 MM MORT IL	106	60	268	145
TOTAL 81 MM MORT WP	0	87	108	65
TOTAL 81 MM MORT HE	2237	1956	3375	2523
TOTAL 155 MM HOW LITR	762	125	2991	1293
TOTAL 4.2" MORT HE	311	348	0	220
TOTAL 4.2" MORT IL	0	11	0	4
TOTAL 40 MM MK 19	0	0	2824	941

Notes:

HOW	Howitzer
MORT	Mortar
HE	High Explosive
IL	Illumination Round
WP	White Phosphorous
LITR	Training Round

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While Tables 4-3 to 4-5 represent the available data, it is not clear how data from these recent years relate to historical levels of use. It is reasonable to expect that historical levels of use were higher when the population at the post was larger. Of course, during periods of heavy troop mobilization (i.e., World War II, the Korean Conflict, the Vietnam War) training range use was likely to be much higher than that of recent years. It is also likely that differences in the level of operations occurred between periods when the post was controlled by the US Army rather than the MAARNG. Finally, it is clear that range activities have changed location through time so that some historic ranges have been abandoned (e.g., Old Range A or the Gravity Anti-Tank Range) and some existing ranges have been used for less than the full post-life.

Attempts to obtain data on historic rates of munitions use at the range area were unsuccessful. As discussed above, by US Army regulation, records on the actual rate of use must only be maintained for one year. As an alternative, inquiries were made about the rate of supply of munitions to MMR. These data were also unavailable from central ammunition supply points (including the Ammunition Supply Point at MMR), due to the Army's and NGB's practice of archiving such records. In addition, data from such locations are likely to over-estimate the actual use at MMR as the distributed materials include those that are carried off-post during mobilizations to other facilities or war theaters.

Efforts were made to ascertain annual figures either on total base population or, more appropriately, training-days spent within the Impact Area in order to estimate historic rates of firing from more recent records. Under the best of circumstances, this estimate would be very uncertain as number of assumptions regarding base operations would have to be made. Unfortunately, only the most sketchy of data are available on the population of the base. Records available at MMR have little in the way of a coherent record. The MA State Library contained only an incomplete record of the MA National Guard Adjutant General Report. Only some of these available reports had data on post population and then only for the National Guard and not the US Army.

To provide perspective on the rate of munitions use, Camp Edwards, as originally constructed, was intended to house 30,000 troops (US DoD, undated). In 1995, the population of full time base personnel was 1,341 (NGB and MNG, 1996). NGB and MNG (1996) notes that the total number of training-days (including both military and civilian) at MMR in 1994 was 196,989. On the other hand, it is conceivable that, during the war years, when the post was fully populated, the number of training days would have been much higher. For example, if a 20,000 of the post personnel were being trained during a five-day week through out the year, this suggests that in excess of 5,000,000 training days could have occurred each year. This assumes that troops would be trained, mobilized, and replaced by new trainees, a reasonable scenario during World War II. Thus, it is likely that the rate of munitions use during the war years would have been substantially higher (i.e., factor of ten or more) than the recent past.



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**Table 4-5**  
**Demolition Range Utilization**  
 Note: Only data for 1989 were available

Area	Activity/Weapon	Wt	# Shots 1989
DEMO 2	C4/TNT HIGH EXPLOSIVES	1 LB	1356
DEMO 1	C4/TNT HIGH EXPLOSIVES	1 LB	168
	SHAPED CHARGE	5 LB	56
	SHAPED CHARGE	40 LB	82
	BANGALORE TORPEDO		191
	40 MM HE (1)		1
	81 MM HE (1)		12
	105 MM HE (1)		9
	4.2 MM HE (1)		5
	155 MM HE (1)		1
	M6 MINE (1)		1
	C4 (1)	1.25 LBS	191
	CHARGE, DEMOLITION M118 (1)		11
	DETONATOR CORD (1)	400 FT	
	SHAPED CHARGE (1)		3
	HAND FRAGMENTATION GRENADE (1)		1
TEXTRON (2) 732222	WARHEADS (OCTOL)	2 LB	50
TEXTRON (2) 732222	WARHEADS (OCTOL)	6 LB	12

Notes: (1) Items disposed of by EOD at DEMO 1.

(2) This is part of the Textron (formerly AVCO) test program at Camp Edwards and involves the static detonation of a warhead containing Octol to test the penetration ability of the warhead.

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Based on this rate of usage, it is very likely that the amount of munitions used at MMR is in excess of 200 times the annual amount used during one of the recent years. That is, the total amount used at MMR is approximately equal to the average annual rate of recent years multiplied by 200. It is not likely that historical average rates of use were 200 times the recent historical rates. This estimate derives from the facility being active since 1911 with several years having a very high rate of use (i.e., more than ten times the current rate). While this is a very rough estimate of total munitions usage, it is all that the available data support.

## 4.3.1 Estimation of UXO Density

As discussed above, one of the goals of the archive search was the estimation of munitions density, including UXO, at MMR. Such an estimate is possible based on the rate of munitions use, the probability of a dud, and knowledge of the dimensions of areas impacted. Unfortunately, none of these parameters is known with any degree of certainty. As described above, the average rate of munitions use at MMR is poorly known. Similarly, the rate of duds is not well known. Discussion with individuals at Range Control, the US Army Cold Regions Laboratory, the US Army Waterways Experimental Station, the Unified Environmental Program Office, the National Guard Bureau, and the US Army Environmental Center were unable to derive a formal estimate of the rate of duds. The problem is exacerbated by uncertainty regarding the nature and reliability of historical munitions. A consensus, but unofficial, rate of duds is two percent<sup>1</sup>. Even the dimensions of the area affected are difficult to know with certainty. UXO is likely to be most dense in the immediate vicinity of the target. The density is very likely to decline with distance from the target. This issue makes it difficult to estimate a discrete area that will contain all of the UXO.

A more promising approach is to estimate the density of UXO from the ongoing clearance of UXO from the Impact Area. As of July 4, 1997, approximately 17.4 acres of the Impact Area have been investigated for magnetic anomalies and the anomalies have been evaluated for potential explosive hazard by intrusive techniques. The goal of the evaluation is the identification and ultimate removal of objects that pose an explosive hazard during the ongoing investigation. The clearance technique results in the removal of UXO to a depth of two feet below grade. The areas evaluated include those immediately adjacent to long-term locations of targets (e.g., Turpentine Road and Tank Alley) as well as those that are likely to have a lower density of UXO (e.g., roads near the perimeter of the Impact Area).

The information gathered during the clearance activity is the most direct means of estimating the density of UXO in the Impact Area. Table 4-6 provides a summary of the areas investigated, their dimensions, the number and type of UXO found, and UXO density per acre. As would be

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<sup>1</sup> This is based on US Army requirements that shipped munitions have a high (e.g., 99%) rate of successful detonation and the fact that long-term storage of munitions may reduce effectiveness (see telephone communication summary with T. Walch, Appendix A).

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Table 4-6.  
Estimated UXO Density  
Potential Explosive Ordnance Discovery  
through July 4, 1997

Location	Area ft <sup>2</sup>	Area Acres	Object Found	# found	Depth in.	UXO Density acre <sup>-1</sup>	UXO Density ft <sup>-2</sup>
Sandwich Rd.*	97,416	2.24	81mm mortar practice 105mm projectile WP 6" projectile shrapnel	3 1 1	8 - 13 8	2.24	5.13E-05
Spruce Swamp Rd.*	41,580	0.95	2" HE mortar 60mm mortar HE	5 1	0.5 - 8 surface	6.29	1.44E-04
Drilling Site 1	15,000	0.34	155mm projectile TNG	4		11.62	2.67E-04
Wood Rd.*	118,800	2.73	4.2" mortar illumination	1		0.37	8.42E-06
Turpentine Rd.*	80,190	1.84	81mm mortar HE 60mm mortar HE 105mm HE	1 2 2	18 5 - 6 12 - 14	2.72	6.24E-05
Turnaround Area	3,750	0.09	81mm mortar HE	1	4	11.62	2.67E-04
Succonsette Pond, Area 8 <sup>1</sup>	14,850	0.34	2.36" rocket HEAT	1	surface	2.93	6.73E-05
Decon Pad	24,000	0.55		0		0.00	0.00E+00
Gravel Staging Area	10,000	0.23		0		0.00	0.00E+00
Path to Site 2	2,400	0.06		0		0.00	0.00E+00
Wheelock Rd.*	63,360	1.45		0		0.00	0.00E+00
Barlow Rd.*	31,680	0.73		0		0.00	0.00E+00
Jefferson Rd.*	79,200	1.82		0		0.00	0.00E+00
Knot Hollow Rd.*	47,520	1.09		0		0.00	0.00E+00
Chadwick Rd.*	95,040	2.18		0		0.00	0.00E+00
Tank Alley*	32,670	0.75		0		0.00	0.00E+00
Total Cleared Area	757,456	17.39		23		1.32	3.04E-05

Notes:

\* Assumes road width cleared of 15 feet.

1. Estimated area as 15' band around Succonsette Pond as measured from range map.

Items found with no explosive hazard:

3 ea. 2" mortar HE

1 ea. 81mm mortar illum.

3 ea. 4.2" mortar illum.

2 ea. 155mm projectile TNG

1 ea. 2" rocket motor

30 ea. 2" rockets TNG



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expected, the density of UXO varies depending on the location in question. Areas adjacent to targets (e.g., Drilling Site 1) have relatively high densities while no UXO was found in other areas. For the purposes of illustration, an average UXO density of the cleared areas is calculated from the total number of UXO and the total cleared area. Given that heavily impacted areas dominate the clearance activities, this estimate should be considered to be an over estimate of the UXO density for the entire Impact Area. It should be noted that UXO might exist below the two feet interval. While this is true, the frequency of UXO below that depth is likely to be less than encountered in the shallower soils.

## *4.3.2 Depth of UXO*

The depth of any UXO has the potential to affect the conceptualization of any potential source(s) to groundwater as well as the parameters of the site characterization (e.g., the depth of sampling, depths of UXO clearance). The depth of penetration of a projectile is a complex function of the nature of the soils, the mass and shape of the projectile, the trajectory of the projectile, and whether it explodes successfully. While modeling of this process is possible and is being considered, such efforts will not be available prior to the characterization of this site.

Discussions with representatives of the Explosive Ordnance Disposal group at MMR (see telephone communication summary - Spilhaus, Appendix A), indicate that it is possible to find unexploded ordnance at relatively great depth (i.e., over ten feet). This is driven by the significant momentum of the shell as well as the fact that soil materials could be deposited on top of the UXO following the penetration. To illustrate that the penetration of UXO is difficult to predict, Staff Sergeant Spilhaus mentioned that shells have been known to "dolphin" or initially dive deep into the ground but ultimately come to rest closer to the surface.

## **4.4 Other Range and Impact Area Practices**

In addition to practice firing, a number of other training related activities occurred within the Range area. An example of such activities includes waste disposal practices. In general, such activities are not well documented by Range SOPs and regulations. Some information was obtained on practice at one specific area (CS-19) and is included as Appendix G. Information relevant to defining the location, timing, and extent of such practices has been found during interviews with persons with historical perspective on the post. Summaries of the interviews that have been completed to date are included in Section 5.0. Information gleaned from these interviews has been included in the relevant summaries of those locations (e.g., Appendices C and E for summaries of firing ranges and mortar/gun positions, respectively).

### *4.4.1 Historical Activities as Evidenced by Aerial Photographs*

A number of cleared areas and physical features are evident in historical aerial photographs of the training range and Impact Area. These features are defined in the Aerial Photographs Site Analysis report prepared for US Army Environmental Center (1994) and were used extensively to define the scope and location of the investigation as outlined in the Action Plan. Tables 4-7 through 4-11 summarize each feature that is apparent on these photos that may be indicative of a

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**Table 4-7**  
**HISTORIC TARGET AREAS FROM AERIAL PHOTOS**

<b>Name</b>	<b>Source</b>	<b>Location</b>	<b>Activity</b>
TA-1	1943 Air Photo - ERI, 1994	South of Five Corners between Pocasset Sandwich and Turpentine Roads	Impact craters visible
TA-2	1951 Air Photo - ERI, 1994	North of and overlapping TA-1 south of Five Corners	Circular cleared target area; aircraft parts described in Zanis interview
TA-3	1951 Air Photo - ERI, 1994	"Site 1" East of Turpentine Rd. and north of future Tank Alley	Circular cleared target area
TA-4	1951 Air Photo - ERI, 1994	"Site 2" East of Sandwich Rd.	CS-19 (see IRP reports)
TA-5	1963 Air Photo - ERI, 1994	"Site 3" Southeast of TA-2 on east side of Turpentine Rd.	Rhomboid-shaped cleared target area with 2 antenna and possible tower
TA-6	1963 Air Photo - ERI, 1994	"Site 4" East of TA-3 on Tank Alley	Earthen mound for one of the J ranges; use of targets hoisted up on poles described in Zanis interview
TA-7	1971 Air Photo - ERI, 1994	"Site 5" Southeast of TA-6 on Tank Alley	Earthen mounds for one of the J ranges

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**Table 4-8**

## **HISTORIC CLEARED AREAS FROM AERIAL PHOTOS**

**Characteristics:** vegetation removed, graded flat, regularly shaped, with easy vehicular access  
(possible firing, observation, troop/vehicle assembly sites)

<b>Name</b>	<b>Source/Function</b>	<b>Location</b>
CA-1	1943 Air Photo - ERI, 1994	North of Wood Road at intersection w/ Spruce Swamp Road (AKA Goat Pasture Road)
CA-2	1943 Air Photo - ERI, 1994	North of Wood Road at Five Corners
CA-3	1943 Air Photo - ERI, 1994	East of Pocasset Sandwich Road adjacent to Site #3 Target Area
CA-4	1943 Air Photo - ERI, 1994	With limits of Site #3 Target Area on west side of Turpentine Road
CA-5	1943 Air Photo - ERI, 1994	West side of Turpentine Road 1 1/2 miles south of Five Corners intersection
CA-6	1943 Air Photo - ERI, 1994	South side of Wheelock Road 1/3 mile east of Pocasset Sandwich Road intersection
CA-7	1951 Air Photo - ERI, 1994	Just east of the Site #1 Target Area circle
CA-8	1958 Air Photo - ERI, 1994	1/4 mile north of Five Corners intersection on the west side of road
CA-9	1966 Air Photo - ERI, 1994 (possible tank trail)	East-west linear feature running from Pocasset Sandwich Road south of Site #1 - possible observation point for impact area to the east
CA-10	April 10, 1977 Air Photo - ERI, 1994	"Site 6" on Monument Beach Road 300 feet north of Pocasset Sandwich Road
CA-11	1977 Air Photo - ERI, 1994	Off loop road around "J" Range approximately 1/4 mile west southwest of Site #5
CA-12	1991 Air Photo - ERI, 1994	North of Wheelock Road 1/3 mile east of Pocasset Sandwich Road

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**Table 4-9**  
**HISTORIC BUNKERS FROM AERIAL PHOTOS**

<b>Name</b>	<b>Source/Function</b>	<b>Location</b>
BK-1	1943 Air Photo - ERI, 1994	East of Pocasset Sandwich Road at Site #2
BK-2	1943 Air Photo - ERI, 1994	Just west of loop road around "J" Range 1/2 mile north of Impact Area boundary
BK-3/4	1943 Air Photo - ERI, 1994	Two bunkers east of Pocasset Sandwich Road south of Succonesett Pond
BK-5 ?	1951 Air Photo - ERI, 1994 (possible bunker)	South side of Wood Road approx. one mile east of Five Corners



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**Table 4-10**  
**HISTORIC BURN AREAS FROM AERIAL PHOTOS**

<b>Name</b>	<b>Source/Function</b>	<b>Location</b>
BA-1	1958 Air Photo - ERI, 1994	Adjacent to and south of Site #3 Target Area
BA-2	1958 Air Photo - ERI, 1994	West of Turpentine Road across from Site #1
BA-3	1958 Air Photo - ERI, 1994	East of the Site #2 perimeter road
BA-4	1958 Air Photo - ERI, 1994	Southeast side of Pocassett Sandwich Road and south of Site #2
BA-5	1958 Air Photo - ERI, 1994	1/3 East of Turpentine Road and 1/3 north of the Impact Area boundary
BA-6	1958 Air Photo - ERI, 1994	Adjacent to the Impact Area southern boundary just west of Turpentine Road
BA-7/8/9	1958 Air Photo - ERI, 1994	Three separate areas grouped roughly 1/4 mile west of Turpentine Road 1/2 north of the Impact Area southern boundary
BA-10	1958 Air Photo - ERI, 1994	Southwestern corner of the Impact Area 1/4 mile from the Wheelock Road and Pocassett Sandwich Road intersection
BA-11	1991 Air Photo - ERI, 1994	1/4 mile east of Turpentine Road just north of Site #1
BA-12/13	1991 Air Photo - ERI, 1994	Either end of loop road around Site #5 between "J" Range and Wheelock Road

Note: Probable burn site within Site #1 Target Area (see Table 4-7)

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**Table 4-11**

## **HISTORIC DISTURBED GROUND/GROUND SCAR/TRENCHES/EXCAVATIONS FROM AERIAL PHOTOS**

<b>Name</b>	<b>Source</b>	<b>Location</b>	<b>Activity</b>
GS-1/EX-1	1943 Air Photo - ERI, 1994	At the intersection of Monument Beach and Pocasset Sandwich Roads	Unknown
GS-2/3/4/5/6	1943 Air Photo - ERI, 1994	Five scars along a 1-mile stretch of Wood Road approx. 1 mile west of Five Corners	Unknown
GS-7	1943 Air Photo - ERI, 1994	On the east side of Turpentine Road within the Site #3 Target Area	Unknown
GS-8	1951 Air Photo - ERI, 1994	On the road leading northeast approx. 1/4 mile from Five Corners (becomes CA-8)	Unknown
EX-2	1951 Air Photo - ERI, 1994	East side of Pocasset Sandwich Road just west of Site #3 Target Area (coincident with CA-3)	Unknown
PIT-1/2	1951 Air Photo - ERI, 1994	Two pits associated with Site #1, one within the Target Area - the other just south of CA-7	Unknown
GS -9	1958 Air Photo - ERI, 1994	Just south of Wood Road approximately 1/2 mile east of Five Corners	Unknown
TR-1/DG-1	1958 Air Photo - ERI, 1994	Trench and disturbed ground on northern side of Site #2	CS-19 (see IRP reports)
DG-2	1958 Air Photo - ERI, 1994	On the south-central portion of Site #2 600 feet south of BK-1 - associated with impact craters	CS-19 (see IRP reports)
GS-10	1958 Air Photo - ERI, 1994	Associated with topo. depressions in the southeastern corner of the Impact Area near Wheelock Road - impact craters	Unknown
GS-11	1958 Air Photo - ERI, 1994	Topographic depression just north of Five Corners - associated with impact craters	Potential dumping location described in Zanis Interview
TR-2/3/4	1963 Air Photo - ERI, 1994	Three separate trenches within the Site #3 newer Target Area east of Turpentine Road	Unknown
PIT-3/4	1963 Air Photo - ERI, 1994	Two pits located in the center of Site #2 with associated impact craters (contain liquid in 1971 and 1977)	CS-19 (see IRP reports)

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**Table 4-11**  
**HISTORIC DISTURBED GROUND/GROUND SCAR/TRENCHES/EXCAVATIONS FROM AERIAL PHOTOS**

Name	Source	Location	Activity
DG-3	1963 Air Photo - ERI, 1994	At Site #2 east of tower - redisturbed in 1970	CS-19 (see IRP reports)
TR-5	1963 Air Photo - ERI, 1994	North of Wheelock Road at the intersection with Turpentine Road	Unknown
TR-6/7	March 1971 Air Photo - ERI, 1994	Two newly-installed trenches within Site #5 (contain rain water? in August 1971)	Unknown
TR-8/9/10	August 1971 Air Photo - ERI, 1994	Three more trenches identified at Site #5	Unknown
GS-12	April 1977 Air Photo - ERI, 1994	On Wood Road 400 feet west of Five Corners	Ramp for potential dumping described in Zanis interview
PIT-5	April 1977 Air Photo - ERI, 1994	Third pit excavated at Site #2 - also liquid filled	CS-19 (see IRP reports)
TR-11/12	April 1977 Air Photo - ERI, 1994	Site #5 - two additional trenches observed	Unknown
TR-13	1991 Air Photo - ERI, 1994	Deep trench at Site #5 - a total of 8 trenches mapped at this location	Unknown

Note: Numerous ground scars appear in 1991 air photo at former burn areas, target areas, and just inside the Impact Zone along Jefferson Road near intersection with Spruce Swamp Road



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potential groundwater impact. The features are sorted into target areas, cleared areas, bunkers, burned areas, and other surface disturbances. Each feature is provided with a unique designation. The source of the observation as well as a narrative description of the location is provided. Finally, information regarding the activity at the feature is provided along with the source of that information. This includes information obtained from interviews and the Range SOPs. Occurrence of features at known mortar/gun targets is noted.

## *4.4.2 Historical Information on Contractor Activities*

Three contractors are known to have performed weapons testing at MMR. These include Textron (formerly AVCO), Hesse Eastern, and Atlantic Research. Textron has maintained their activities in recent years, although they have suspended testing of explosives in accordance with the current restrictions under the Administrative Order. Textron has provided a summary of their recent testing activities at J-3 range (provided as Appendix H). Textron is investigating the nature of their historical activities, but they are believed to have been similar in scope and magnitude to current operations (see telecon for Tannin, Appendix A). AVCO is believed to have had access to J-3 range since 1968 with a written lease since 1978. AVCO was purchased by Textron in 1984. While Textron is known to have activities at J-3 range, it also had an access agreement for J-1 range. The scope of Textron's activities at J-1 range, if any, are not yet known, although information collection is continuing. There is anecdotal information that J-1 range was used by Atlantic Research prior to Textron's access agreement.

The two other contractors, Hesse Eastern and Atlantic Research, were working for the Department of Defense and apparently obtained their access agreements through DOD. The nature of their activities is not currently known. Efforts are ongoing to identify, through the Army Corps of Engineers contracting authorities, the nature of these operations as well as the locations of the companies or companies that may have acquired them.

## *4.4.3 Hazardous Material Handling Procedures*

Current hazardous material management at the various maintenance shops at MMR is in accordance with applicable fire (MA Board of Fire Prevention) and safety (OSHA hazard communication) regulations. Current inventories of hazardous materials are maintained at each shop as required by law. A central inventory of all materials purchased post-wide is not available at MMR. NGB will investigate whether such an inventory is maintained for MMR by the US Property & Fiscal Office, and if it is available for earlier time periods.

Hazardous wastes (as defined under RCRA and 310 CMR 30) are generated by the various maintenance shops at MMR. Current hazardous wastes include solvent (Safety-Kleen, mineral spirits, acetone, isopropanol, toluene, xylene), petroleum (gasoline, JP-8, diesel, lube oil), battery fluid (sulfuric acid), paints including aerosol cans, and antifreeze based on 1996 manifests. Biennial reports from 1995, 1993, and 1991 indicate that hazardous wastes have also included investigation-derived wastes from environmental studies, corrosive materials (sodium hydroxide, muriatic acid, hydrochloric acid, chromic acid, nitric acid), batteries (cadmium), petroleum-



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contaminated filters and rags, film developer (silver), and other solvents (trichloroethylene, benzene). These waste types appear to be consistent with the vehicle and equipment maintenance operations that are conducted by the Army National Guard at Camp Edwards. Wastes are transported offsite and disposed in accordance with applicable regulations, under the management of the Camp Edwards Environmental Office. These regulations have generally been in effect since about 1980. The interviews provided in Section 5 discuss some relevant observations about earlier waste handling procedures (e.g., incidental disposal of waste oil in the training range areas during training operations).

#### *4.4.4 Other Activities Described in Interviews*

Other activities have occurred within the Training Ranges and Impact Area which could have impacts on groundwater quality, and which do not appear to be associated with the designated firing ranges, gun and mortar positions, contractor ranges, areas visible on aerial photos, or hazardous material handling practices. The following activities were identified in interviews (see Section 5.0), on maps, and/or in IRP reports:

- **Water Training at Ponds.** Interviews with Zanis and Cimino indicate that Deep Bottom pond was used for water purification training, by addition of treatment chemicals prior to returning water to the pond. The pond is designated as "Water Training Site" on the 1949 Range Map. Deep Bottom pond was also dredged in an attempt to deepen it (substantiated by Jacobson interview). The Veloza interview indicates that water purification training was also conducted at the two ponds on the Rod and Gun Club.
- **Defoliation of Power Line Right-of-Ways.** The Cimino interview indicates that defoliant was sprayed by airplane along the power lines by Gibbs Road around 1980. The Zanis interview indicates that defoliant was applied by truck spraying along the right-of-way near Donnelly Pond and Deep Bottom Pond, and drums of defoliant were staged in these areas.
- **Army Application of Pesticides.** The Cimino interview indicates that the Army sprayed pesticides by truck in low areas near Gibbs Road prior to 1974.
- **Smoke Grenade Use in Bivouac Areas.** The Zanis interview indicates that smoke grenades have been used heavily throughout the Training Ranges, particularly in areas C13, C14, C15, Land Nav 11, Pine Hill, and A4 (see the 1994 Range Map). Artillery simulators have also been used in these areas.
- **Dropped Darts on Turpentine Road.** The Zanis interview indicates that air-to-air target darts were dropped along Turpentine Road. Composition of these darts is unknown.

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- CS Gas Training in Bivouac Areas and Chambers. Interviews with Cimino, Zanis, and Nelson indicate that CS gas canisters were used in open areas and quonset hut “chambers” for training with gas masks. The open areas included Wheelock Road across from Range Control, near GP-24, near area A5, near Land Nav 11, and south of Donnely Pond.
- 50-cal. Machine Gun Targets in Impact Area. The Zanis interview indicates that several areas within the Impact Area were used for 50-cal. machine gun targets, including drums located on a ridge south of Succonsette Pond, and automobiles located along Tank Alley west of Turpentine Road.
- Bunkers and Pits at the J Ranges. The Zanis interview indicates that bunkers were present at the J ranges where shaped charges were assembled. Pits in these areas were used for disposal of shaped charges, including one steel-lined square pit located southeast of the buffer zone where the J-2 range crosses Chadwick Road. The bunkers and pits were later bulldozed, except that the steel pit may still be there.
- Boulder Demolition West of Impact Area (Demo Area 3). The Nelson and Zanis interviews indicates that boulders were demolished using high explosives, at numerous locations along Avery Road, Ben’s Hollow Road, and Monument Beach Road during the 1970’s.
- Truck Demolition South of Impact Area (Demo Area 4). The Zanis interview indicates that demolition of 5-ton trucks using high explosives was performed in an area along Wheelock Road east of Turpentine Road, in the 1980’s.
- BOMARC Site. The Nelson interview indicates that contaminants were visible at the surface after decommissioning of this site, prior to construction of the UTES. The Zanis interview indicates that workers in full containment suits were observed outside the fenced area in the 1980s.
- Engineer Training Site. The Cimino interview and the 1949 Range Map indicate that an engineer training site was located south of Spruce Swamp. This area included field fortifications, rope tying and rigging, an engineer equipment site, and a (dummy) mine warfare site.
- Rod and Gun Club Ranges. Based on the Veloza interview this area includes a skeet range, a pistol range, and a high-powered rifle range (now closed).
- Pond Dumping. The Manfreidy interview and Zanis comments on the Action Plan (see Section 5) suggest that munitions have been dumped in ponds in the training range areas.

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## 5. INTERVIEWS WITH PERSONNEL WITH HISTORICAL PERSPECTIVE

Interviews are a key component of collecting information on historical range activities since written information regarding these activities is limited. Also, activities might not be documented in written procedures if there are negative environmental impacts associated with them. Interviews with several key personnel have been conducted, and personnel for future interviews have been identified. A notice requesting that members of the public having information on range activities volunteer for interviews was published in the Cape Cod Times on June 8, 1997.

Personnel that have been interviewed to date include the following:

Person	Association with MMR	Time Period	Interview Status
Paul Zanis	Rode motorcycles onsite	1960 - 1997	done 6/5
Anthony Cimino	Fac. Engr., Dep. Commander	1967 - 1994	done 6/11
Chet Nelson	CW Officer at UTES	1948 - 1985	done 6/11
Dave Jacobson	Facility Engr.; Env. Engr.	1974 - 1997	done 6/25
Mike Veloza	Pres. Rod & Gun Club	1977 - 1997	done 6/30
Tony Manfreidy	Range Officer, UTES Chief	1974 - 1996	done 6/30

These initial interviews have identified additional candidates for interviews, including Range Control Officers, other Range Control personnel, and Facilities Engineering personnel. Also, EOD personnel were identified during the CS-19 interviews under IRP, who may have knowledge of dud UXO disposal areas. NGB is currently investigating the availability of these candidates for continuing the interview process. Results of continuing interviews will be provided to USEPA, MADEP, and other stakeholders via the weekly updates and other meetings conducted during the Impact Area Groundwater Study.

Summaries of interviews are provided below. These summaries were prepared based on notes and a tape recording of each interview.



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## 5.1 Paul Zanis, June 5, 1997

The interview was conducted by Marc Grant and Jane Dolan, and included LTC Richard Murphy for the first hour.

Mr. Zanis has ridden off-road motorcycles throughout the Impact Area and Training Ranges during various periods from the 1960's to the 1990's.

Mr. Zanis described the area at Deep Bottom Pond, which is marked as a "Water Training Site" on the 1949 map. This was originally an oval-shaped pond that was cut in half. The bottom was bulldozed out and dumped 50 yards to the north. A group of soldiers sucked most of the water out of the pond into bladders for treatment. A soldier informed Mr. Zanis at the time that this was training to supply personnel with water. These operations were conducted around 1970. Boxes of water treatment chemicals were used by this group. The water was dumped back into the pond after treatment. The pond appeared stagnant, slick, dead, and green after these operations, which lasted several months and reoccurred yearly.

Defoliant was applied by Asplundh trucks spraying the power lines right-of-way that run north-south in this area. Drums of defoliant were staged in several places, including a huge pile in a valley along the canal power lines with extensive defoliation. Drums were staged 50 yards north of Donnelly Pond. Trucks were hosed off using water from Donnelly Pond and Deep Bottom Pond. The heaviest defoliant use appeared to be along the north end of the power lines. These operations were observed from about 1972 to 1980. The drums were orange and were marked with various chemical names or ingredients including malathion and Tordon 101, a chemical made by Dow. The depression northwest of Deep Bottom Pond (marked "Cranberry Bog" on the 1949 map) collected runoff from the power lines. There is not much growing in this area.

Mr. Zanis described the Anti-Tank Gravity Range (marked on the 1949 map) nearby on Wood Road, where 3 different projectiles from a 37mm gun were found. These appeared to be inert rounds. Guns were fired from near the "A" position on the 1949 map. Targets would slide down the hill on rail tracks. 50-cal machine guns were heavily used in this range, and later bazookas. The 50-cal munitions were largely ball type rather than armor piercing, consisting of a copper jacket with a lead core. Mr. Zanis collected much copper in this area for selling to a scrap dealer. A lot of tracer ammunition was also used, containing phosphorous. The west side of the hill where these munitions accumulated looks different now because soil has slid down, covering much of the tracks. The bazookas and machine guns were fired at stationary wooden targets built on the hill near the tracks. Bazooka rounds were inert and were observed sticking out of the wooden targets. These operations were believed to have occurred in the late 1950's, based on information gathered by Mr. Zanis.



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At Site 4 targets were hoisted up on poles and used to determine munition trajectories. 20-mm, 30-mm, and 105-mm munitions were fired from the J ranges at steel plate targets on earthen backstops. The mounds at Sites 4 and 5 were observed to contain some dud rounds. The first ranges in this area were used in the 1960's. Mr. Zanis observed one range abandoned around 1968, and materials were left in place at the bunkers where shaped charges were made. The bunkers were later bulldozed. Several pits were located in this area where shaped charges made of Composition B were disposed. These included a steel-lined square pit located southeast of the buffer zone where the J-2 range crosses Chadwick Road. (A dark spot appears at this location on the 1991 aerial photo). Metal debris was observed at the northwest end of the J-2 range. "Smart bomb" tests were performed on the AVCO J range in which a Russian tank was driven around to test a heat-sensing airborne munition. Trenches and pits visible on the 1971 aerial photos were observed to contain precipitation due to the clayey soils in this area, which seem to hold water.

A marked difference in the deer population was observed inside and outside the Impact Area, with much healthier deer observed outside the Impact Area.

Wire-guided rockets and infrared-guided rockets were fired from a range in the vicinity of the KD range. Also, tank gunnery firing of live rounds was performed in this area. A grenade launcher range was observed south of the area labeled "J range" on the February 1966 aerial photo. Kids from the Forestdale area were observed trespassing in this area, and Mr. Zanis warned them about touching live munitions.

Demo-1 was a round kettlehole which almost always had water at the bottom. Mr. Zanis estimates the bottom was 30-50 feet deeper than it is now, approximately as deep as Opening Pond. Filling is believed to have occurred after 1988 based on its current appearance. Large quantities of C4 explosive, confiscated fireworks, and munitions were visible on the surface of this area. Quantities of explosives in this area were greater than in the Impact Area. Some metal debris was observed around Opening Pond, but not notable amounts of munitions. The May 1963 aerial photo shows a road looping around the Demo-1 area. After his interview with ABB and at their suggestion Mr. Zanis searched this area, but nothing notable was observed.

Tunnels were present in training area BA1, also an airplane fuselage.

The landfill was used for a motocross track at one time. A retired Air Force pilot warned riders off of the landfill, saying that munitions were buried there. Riders also used the sewage disposal area near the southern perimeter of the base.

Nothing notable was observed at the Rod and Gun Club. A more heavily used private firing range was located along the Canal west of Discovery Hill, where a park is located.

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Drainage areas along the runways had petroleum spills that the riders smelled when riding through here. Metal debris and drums were observed in the woods east of the Otis Air Force Base runways.

75-mm rounds were observed west of the Impact Area on the ridge along the east of Burgoyne Road. These contained lead balls with a purple wax. Mr. Zanis later read that the rounds contained black powder and a steel washer to fire the lead balls.

Mr. Zanis observed demolition of boulders in training areas B7, B8, and B9, along Avery Road, Ben's Hollow Road, and Monument Beach Road, during the late 1970's. He has previously referred to this as "Demo Area 3". Some waste explosive was observed in this area, but not nearly as much as at Demo-1.

Demolition of 5-ton trucks was performed east of Turpentine along Wheelock in the 1980's. A sheen was observed on the ground where lubricants had been released. Debris from these demolitions was bulldozed south into the woods. He has previously referred to this as "Demo Area 4".

Natural springs are present upstream of Upper Pond, west of the post.

## Additional Information Received from Paul Zanis by telephone, 6/11/97:

Mr. Zanis reaffirmed his recollection of the Demo-1 area having been filled. Operations at Demo-2 included digging a hole at the base of this area, setting a charge, and filling the hole back.

Lincoln Labs operated on the J-2 range. Research on 60-mm mortars was conducted there. A Mr. Woodbury or Woodburn was in charge of these operations.

A fuel spill (FS-12?) was caused by AVCO doing bulldozer work. Carbon disulfide was used by AVCO for cleaning operations and was still present here after the facility was abandoned. Some of the disposal pits mentioned in the earlier interview were bulldozed, but the steel-lined pit may still be there.

Mr. Zanis and at least one other motorcycle rider encountered some workers in yellow full containment suits in a sandy pit or clearing on the northwest side of BOMARC (outside the fence). He did not observe what these workers were doing. The suits had blue Air Force insignia and also radiation hazard markings. This was about 12 years ago.

## Paul Zanis comments on the Draft Action Plan dated April 20, 1997

The following comments were received on the Draft Action Plan which also contain information on areas of environmental concern:



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This is my response to Paul Marchessault's write up of the site visit on March 8, 1997. Paul was not present to hear all my remarks at the different areas we visited that day. First off Sally Pry rocks and do not disturb sign were bulldozed on the other side of the street from where we first stood when the Guard did their last expansion project.

Bailey's pond is of interest because it is a dumping area. I pulled a heavy artillery projectile with the lifting ring still in place and put it in the middle of the road so it would be found and properly disposed of. Other things have been found there also (powder bags and 50 cal ammo),.

The muddy road we took I call demo area 4 where all the boulders have been blown up down to Deep Bottom pond, including the railroad tracks at the base of the hill and some boulders along the ridge line borders to the south across the tar road for the next two miles. Also the bridge at deep bottom pond. If it took 2 lbs of C4 they used 20 lbs.

B-9 range has tons of 50 cal bullets and it's all covered up from hills washing out. Thousands of Bazooka rockets with spent rocket motors containing propellant number 7. Also this was a tank gun range where I have identified two types of projectiles (37mm) both containing tracer elements as do every fifth 50 cal round. The tracer element is made up of phosphorus on all projectiles. There were also stationary targets at this site. This site was used before world war II until the late 1950's.

Deep bottom pond was cut in two around 1980 for a water works div. on maneuvers. Their job was water supply, they pumped the water into huge rubber tanks for treatment and storage. The bottom of the pond is about 100 yards to the north. All life in the pond was killed (The biggest bullfrogs we had ever seen were there).

The subject of defoliation covers all the power lines and fire lanes (widened dirt roads and the impact area). The spray trucks I saw were either using the water or washing their trucks.

Donnelly pond was the main staging area for defoliation (orange drums laying around). The water works area had residue on all the banks including fireworks, C4, detonators etc. This area should be approached with caution.

CS-19 report is clear but I only saw a tanker truck once in 1969, but there was a large pipe sticking out of the ground in the hole and lots of rusty filter cartridges there besides everything else.

I did not get to show Paul the Valley of death. I saw a ramp bulldozed at the top of the hill and plenty of tracks from trucks but never saw trucks there, (they took one way in and one way out) remember I entered the impact area on wood road passing by the valley on my left turning right to get to my bunker. There have never been bulldozers in the valley and I can prove it.

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The impact area has been a dumping area all along and is today (hundreds of chaff canisters, rocket motors, stuff from AVCO, junk). I can prove it, it all gets blown up and sent into the air and water. I wanted to walk turpentine road at the center of tank ally I call ground zero where after a Saturday of artillery practice the ground would be smoking and it stunk. I estimate 200 heavy artillery rounds are fired on a good day. From one of the observation post I would sit and watch the artillery practice. Salvos of five or six rounds would fly over and hit causing a huge cloud of red dust high into the air with a lower dark cloud from the explosion itself (composition B) floating east sometimes west if it came towards me I usually left. I was on the northwest side of the impact area most of the time.

Demo area 3 is the truck bomb area I could not show.

The law rocket range is a sight to see. Thousands of rockets lying around.

Areas of smoke grenades rusting. Every year another 1000 get left on the ground. I showed one on the B9 range.

The chemical warfare gas chambers. I've been gassed involuntarily.

## 5.2 Anthony Cimino, June 11, 1997

The interview was conducted by Marc Grant.

Mr. Cimino trained at MMR as an engineer with a special Guard battalion from Worcester during the period from 1967 to 1974. In 1974 when the Guard took over the post he became a Engineering Officer, and drilled here until 1981. He worked as a Deputy Commander from 1981 until 1993, then worked in Facilities Engineering in 1994.

A complete aerial survey was performed in 1986. Materials from this survey were inadvertently destroyed when the unit performing this survey was deactivated, and trucks containing the materials were left outside over the winter. (1984 and 1986 aerial photos are available at Facilities Engineering through Walter Tyler).

Mr. Cimino is not aware of any disposal in the Impact Area, including the natural depressions at Five Corners and Suconsette Pond. The only time people would access this area was for Range Control officers to lead fire fighting efforts, if necessary.

Pit latrines were dug in the range areas until the late 1980's. These were marked with a sign indicating the dates opened and closed. These pits could be anywhere around the range.

Bivouac areas would have pit latrines and pits for gray water disposal from kitchens (fats were collected in grease traps). Waste oil from training operations was drummed and brought to



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Natick for disposal. Targets usually came from salvage yards or the Property Disposal Office (PDO), and petroleum or lubricants were drained prior to targeting.

The anti-tank gravity range was later used for 50-cal machine guns. Ranges were moved east from Frank Perkins Road when Burgoyne Road was constructed.

The Guard planned to make the Water Training Site at Deep Bottom Pond deeper by excavating below the water table. A lot of peat was removed from the bottom, but more peat kept rising. A road was planned across this area to facilitate dredging, but the area could not be excavated as deep as they hoped. Water purification training was conducted at this pond.

Tear gas and smoke training was conducted at a chamber in the CBR site, and in the open throughout the training areas. This had to be limited depending on weather conditions (wind or dryness), but could generally be conducted anywhere.

Mr. Cimino was aware of Hesse and AVCO research operations, but was not familiar with details for these operations. The Guard did not have a lot to do with these ranges, which were leased directly from the DOD. He is not aware of any records kept for these ranges.

The COM/Electric high tension lines along Gibbs Road were sprayed with defoliant from a plane in the late 1970's or early 1980's. When the Army had the post (before 1974) pesticides were sometimes sprayed by truck in the low areas along Gibbs Road, but the Guard did not apply pesticides due to lack of funds.

The Engineer Training Site was established in 1968-69, and included a field fortification site, a rope tying and rigging site, an engineer equipment site, and a mine warfare site (using dummy mines).

Personnel for interviews could include:

- Army Chief of Staff Saladino - in charge before 1974
- Army COL Sheazly & COL Ross - pre 1974, worked out of Fort Devens
- Peter Mixon - Range Control Officer for Guard in 1974 for a short time
- COL Tony Manfredy - became Range Control Officer after Mixon until 1986
- COL Bill Creamer - Commander in 1974 and very involved in the range
- Jack Stockhaus - Engineer for the Guard in 1974
- Ed Pesce - worked in Engineering before moving to AFCEE
- CPT Elaine Vincelette - took over as Range Control Officer from Manfredy in 1986, preceded MAJ Braga

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Army records for the period from 1941 to 1974 were taken when they left, but might be available from the Army. The Guard controlled MMR between 1935 and 1941. Several maps were available for periods between 1949 and 1974, including a 1957 map.

## **5.3 Chet Nelson, June 11, 1997**

The interview was conducted by Marc Grant.

Mr. Nelson was in the MAARNG in 1948, and worked as a technician at MMR from 1950 to 1985 (Chief Warrant officer, retired). Much downgrading of the facilities was observed over this time period as the amount of training decreased.

The BOMARC site was where the Rifle Range is shown on the 1949 map, and was installed in the late 1950's. BOMARC left in about 1973 when all the equipment was flown out, and Mr. Nelson was involved in starting up the UTES in this area. He observed a maroon crystal in dried up puddles, which turned out to be from fuming nitric acid and hydrazine use.

Mr. Nelson supplied the target vehicles for use in the Impact Area, and these were driven out there without draining fluids until about the early 1980's.

J-2 was a contract range used by Hesse Eastern for unusual/new weaponry. Most of the information regarding this range was classified. Mr. Nelson recalls that a 20-ton steel block was used as a target, in addition to tanks and other vehicles. 105-mm rounds were used here. Depleted uranium rounds were also used here. Bob Woodburn ran the program for Hesse. A lot of explosives were handled here and at the AVCO range. One of the sheds had a liquid runoff that was discolored. The J-2 range was hot 90% of the time.

PAVE PAWS was placed at the current location after seismic testing throughout the Impact Area determined that this was the most stable location. After PAVE PAWS was installed, the southern ranges had to reduce charge to avoid hitting it, and ranges were installed along the north side near Gibbs Road. Also, much less training was performed here after PAVE PAWS was installed.

Boulders that were demolished were used for aggregate, with the remnants brought to a local rock crushing plant.

Amphibious vehicle training was performed at Snake Pond during WWII.

Mr. Nelson did not enter the Impact Area except to assist in fire fighting, before the current practice of fire fighting outside the Impact Area was adopted.

USCG buoys that were used for targets were spun around and moved by hits, so that they would move out of the center of the Impact Area towards the edges.

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Motor oil was sometimes changed in the training areas by releasing waste oil to the ground. Tank engines used approximately 23 gallons of oil, and transmissions used 28 gallons.

Training with tear gas was performed in buildings and vehicles at the CBR location (1949 map) and in the open training areas.

Some rounds could not be taken back at Ammo Supply Point, and would be disposed by burying near the gun position. Mr. Nelson ran across some of this buried material when he was excavating a ramp to allow access for a fire truck.

The Director of Logistics (DOL) should have a roster of people that have worked at the range. Enlisted men may be a good source of information because they are always there. The ASP (James Carr) should be contacted because they know what is currently being used.

The shape of the Demo-1 area changed over the years, but wasn't used much in recent years.

## **5.4 Dave Jacobson, June 25, 1997**

The interview was conducted by Marc Grant, with LTC Richard Murphy joining in for a period of about 10 minutes.

Mr. Jacobson first visited MMR in 1974 as a part-time National Guardsman in an engineering unit. Between 1988 and 1992 he was a full-time civil engineering technician involved in the construction of ranges, and in 1992, moved into an environmental position.

Mr. Jacobson was involved only in the burial of trees and brush associated with the construction of fire breaks. Many of the burial sites are beneath the golf course and are now visible as sinkholes. According to Jacobson, trees and brush are no longer disposed of in this manner.

Work inside the Impact Area included construction of fire breaks and performing controlled burns particularly along Turpentine Road, Fire Break Road, and Succonsette Pond.

During his time working inside the Impact Area, he saw no obvious evidence of waste disposal pits nor was he aware of the use of insecticides or herbicides. Waste shell casings were often discovered and stockpiled during the tree cutting activities. This was particularly true of the area along tank alley where 105-millimeter shell casings are observable on the ground surface.

Mr. Jacobson indicated that on the south side of tank alley, the remnants of vehicles are clearly observable on the surface. Other kinds of debris can be found at the J1 and J2 range areas (managed by the government contractors Textron and Hesse) that include heavy gage (3- to 4-



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inch thick) sheet steel, large concrete culverts for tunnels, and underground wire. The northern-most range at "J" was used by Hesse. Mr. Jacobson believes dud mortars were fired there.

With the exception of CS-19 where pipes are observable at the surface, he was not aware of any other pit disposal site in the Impact Area. Mr. Jacobson was also aware of numerous cleared areas, but believes they were used for overnight vehicle parking and not waste disposal.

LtTC Murphy joins interview...

Hard targets (junk motor vehicles) were put into place by either towing or pushing into position; tree clearing was not usually conducted as part of the effort. Occasionally, soil would be mounded up around the trailers delivering hard targets to act as ramps.

Mr. Jacobson indicated that records of fires are kept that contain information on location and acreage and are stored on GIS files.

He has seen evidence of the disposal of solid waste ("trash") in fox holes, but no major disposal activities.

In Demolition Area 1, metal debris (old crane boom, rail road track, ...) has been stockpiled in the past for demolition training exercises. The debris was ultimately hauled off as scrap metal.

Dredging equipment training was conducted at some of the range area ponds approximately 20 years ago.

To Mr. Jacobson's knowledge, vegetation control has always been through mechanical means; he was not aware of the use of herbicides nor evidence of any stressed vegetation other than the effects of explosive impacts.

He has heard about frequent spills at the Bomarc site, but is not aware of deliberate dumping activities.

Historically, the burning of propellant bags was done on the ground or in a ditch along the side of the road. Starting around 1989 or 1990, concrete troughs were used to burn propellant bags and the residue was drummed and hauled off.

Other sources of information: P. Smith (of Sagamore) former artillery officer and full-time auditor, Tony Manfreidy, Bob Frederick (former range control), caretaker (prior to 1974) from Fort Devens, and Bomarc site personnel.

## 5.5 Mike Veloza, June 30, 1997



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The interview was conducted by Marc Grant.

Mr. Veloza has been involved in the Rod and Gun club since 1972. Weapons firing by the club has diminished significantly since that time. In 1972, he was an associate member when it was run by the Air Force Special Services. The club did not exist for the next three years, but was re-established in 1975 with the Coast Guard where it took on a more civilian membership. He is currently, and has been for some time, president of the club, and is currently in the Air National Guard.

Club members are allowed to share a 500-acre parcel jointly with the military. Military training exercises are generally restricted in this designated area. If special circumstances warrant it, military activities conducted in the designated area are coordinated with club activities.

Prior to 1972, the club firing ranges included a high-powered rifle range and skeet range. With the withdrawal of the Air Force in 1972, the skeet equipment was taken. Between 1980 and 1983, the club purchased equipment to re-establish the skeet range. Between 1982 and 1991, Range Control was informed of club activities when the club range was "hot" (active), but Mr. Veloza was not sure if records were kept. After 1991, Range Control has maintained records of what type of ammunition was used and how many rounds were fired by club members.

In the now-closed high-powered rifle range, rifles and shotguns were fired. New Guard regulations forced the closing of this range soon after the construction of the backstop in the 1980s. K-Range is now used by club members one day per year for shot guns just before deer season, and one day per year for black powder weapons before black powder hunting season.

The former high-powered range was originally constructed in the 1960s by the Air Force and never changed location.

Mr. Veloza had no knowledge of explosives use on the club parcel by the military. Exercises performed there by the military included water purification training at the two ponds located within the club parcel. The ponds were allegedly former irrigation ponds for cranberry bogs.

He was not familiar with any herbicide use on the club property by club members or the military.

Historically, the club has stocked pheasant, but bird hunting is no longer allowed on the reservation. The ponds have not been legally stocked with fish. The elevated water temperature precludes trout, but the "front" pond contains bass.

Solid waste generated by club members is containerized in an on-site dumpster and periodically disposed of off-site. The parcel is not fenced-off, however, access is controlled along the access road. Unauthorized access by dirt-bikes from Route 28 does occur.

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Mr. Veloza does not remember seeing stressed vegetation on the club property. Cleared areas on the parcel are done by mechanical bush cutting and mowing by club members.

Hunting on the reservation has been limited to birds (which is no longer allowed) and deer through a wildlife management program organized by the Rod and Gun Club, Division of Fish and Wildlife, the US Army, and the Army National Guard. The recent EPA cease fire order does not effect the deer hunting program. Hunting is open to all areas except areas restricted by the military.

## 5.6 Tony Manfreidy, June 30, 1997

The interview was conducted by Marc Grant.

Mr. Manfreidy began working at MMR on November 16, 1974 during its transition from the active Army Camp Edwards to the Massachusetts Army National Guard. He continued from that time until 1980 in range control and artillery duties. From 1980 to 1988, he served as Range Officer both full- and part-time, Unit Training Equipment Site Chief from 1988 to 1990, and both full- and part-time Range Operation Officer until 1991. Between 1990 and 1992, Mr. Manfreidy was enrolled in the military academy, but maintained his involvement in range activities scheduling. He then was assigned as a maintenance officer from 1992 to 1993, later becoming Logistics Officer until his retirement from the military in October of 1995. He stayed on as a civilian employee until February 1996.

Mr. Manfreidy has personal knowledge of activities performed in the impact area, bivouac areas, and observer posts. He does not believe that waste materials were buried in the impact area, however, munitions were manufactured on-site at the government contract ranges on the eastern side of the Impact Area. Because these government contractors were working for DOD on classified activities, Mr. Manfreidy was never fully informed on what explosives and propellant were being produced on these ranges and whether hazardous materials were buried there.

J1, J2, and J3, as shown on the 1986 DMA V8414S Camp Edwards Special Map, were the government contract ranges run by Textron (formerly Thermodor, Avco, Atlantic Research, and others) and Hesse. Textron ran ranges J1 and J3. J2 was run by Hesse under the management of Bob Woodburn, who is now deceased, between approximately 1985 to 1987. At J2, the M79 grenade launcher was developed, later renamed the M203 grenade launcher. Prior to that, the 81-millimeter mortar was developed/improved. The nearby "I" range was the 45-caliber range.

He is aware of debris burial at the contractor ranges, most of which he referred to as inert (shell casings and other scrap metal) that were later visible at the surface. Mr. Manfreidy cannot specifically remember whether depleted uranium shells were used in these ranges, but he does recall hearing it discussed at one time in the past.



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"Hard Targets" (vehicles such as personnel carriers and automobile bodies used for target practice) were not always stripped of hazardous materials such as lubricated components before they were fired upon. Engines, however, were usually removed prior to use as hard targets. Most targets were airlifted to the area near Succosette Pond in the early 1980s and fired upon by mortars.

Mortar positions were established in several cleared areas around the Impact Area. Some rounds fired at targets did not reach the boundary of the Impact Area. In a 1984 public hearing on the expansion of Camp Edwards noise the Guard established a rule to preclude the future use of any range not used in the prior year. Mr. Manfreidy indicated this new rule was not always followed.

He indicated that the areas adjacent to cleared mortar firing positions were used for the burning of propellant bags (an acceptable practice at the time).

Gun position 19 (GP19), not shown on the DMA map, is located south of Kendrick Road in Training Area B-8 and was used as a two-gun firing position, last used in the early 1970s. The mortar positions located around the Impact Area were used extensively from 1972 to very recently. Mortar Position 3 (MP3) was constructed in the late 1970s or early 1980s.

Mr. Manfreidy is not aware of any disposal in pits near the Five Corners road intersection and indicated that it would be considered dangerous to construct one in an impact area. He further indicated that he had no knowledge of burial anywhere in the Impact Area.

Refuse and other sanitary waste from bivouac area training was often buried. Extra rounds not used at gun positions were generally not buried, his personal policy was to allow unused ammunition to be returned to the ASP.

Some tree clearing activities were conducted in the late 1970s to allow mobility of armored personnel carriers as part of training exercises. Some low-lying areas were used for the burial of cut trees, branches, and stumps generated from the clearing effort (particularly in the northern part of Training Area A-3).

White phosphorous fired from 155-milimeter weapons was not usually fired at the range due to the high fire potential throughout much of the year. He indicated that at MMR, the fire index is generally not low enough for the use of this type of hot munitions. Smoke grenades are also accountable for fires in the Impact Area.

Annual Range Control log books were kept for all munitions fired on the ranges, however, they would not contain information on the quantity of munitions fired. Records on the amounts used were kept by the ASP starting in 1991. Persons who would know where to find this information include: Jose Braga and Maj. Dave Powers (a range control officer from 1987 to 1995/6).



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Mr. Manfreidy indicated that "dud" (unexploded) rounds are likely to be concentrated in the center of the Impact Area. Gun positions (GP6, GP7, GP8, GP9, GP10, GP11) were the most commonly used sites. Positions to the north of the Impact Area were generally not used. An 8-inch gun was allegedly once fired from GP1 (located in Bivouac Area 3) prior to 1974 according to him.

The most common mortars used were the 81-millimeters in the 1970s. 60- and 70-millimeter mortars were fired earlier. He was not familiar with mortars fired during the 1940s as part of WWII training. Late 1970s and early 1980s were the most active training years that Mr. Manfreidy was familiar with.

Training Areas C-14, C-15, and C-16 were typically used as engineer training sites. Training exercises included temporary bridge-building and rope bridge-building. E3 was used as a "light demolition" area (up to 10 pounds of explosive) and E1 was a fixed firing range.

Vegetation removal was done exclusively by mechanical means. Chemical herbicides were not used by the Army. Insecticides (for mosquito control) were not used.

Ponds on the western side of the installation were also used for engineer training, but Mr. Manfreidy is not aware of any disposal or dumping activities. He speculates that some unauthorized dumping activities could have occurred. He also has hearsay evidence of machine gun rounds discovered in Donnelly Pond. He believes this could be the case in several of the ponds outside the Impact Areas.

Steve Fernandes is in facilities engineering (968-5953) and would have more information on historical activities.

S-Range was used for 3.5-millimeter rocket launchers (prior to 1974). At the I Range (currently the grenade launcher range) HE has not been fired since the early 1980s.

Unauthorized civilian dumping occurred on the north side by "the old Route 130".

Bunkers within the Impact Area were used primarily as observation points for personnel. Cleared area near the intersection of Monument Beach and the western boundary road was a staging area for engineering vehicles working on the boundary.

Mounds at the end of range J3 were used as tunnels and backstops in the testing of the tank 105-millimeter SABOT round. The tunnels are lined with concrete to contain SABOT rounds that "sail".

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Targets (armored personnel carriers and scout vehicles) were positioned around Succonsette Pond for the smaller 60-millimeter mortars fired from mortar positions located to the South.

Mr. Manfreidy was not aware of any stressed vegetation areas that were not the result of either fire or mechanical damage due to impacts. Some vehicle maintenance may have been conducted in the region around the Impact Area, but it would not have been widespread. BA-1 is an area where vehicle maintenance may have occurred. Also GP-1, and the old 3500 and 3600 Area are also potential field maintenance areas. These would be prior to 1981 where oil or solvents may have been discharged directly to the ground.

Other sources of information: State Facility Engineer in Milford, MA

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## 6. CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions

The MMR Impact Area, which is part of Camp Edwards, was started as a reserve training facility. It later became a primary military training and staging facility during World War II. Since World War II, the Impact Area and training facilities have been used for military and law enforcement training.

The munitions used at the Impact Area over the years include ammunition for military small arms, machine guns, mortars, and artillery, as well as demolition materials. The activities at each of the range areas are reasonably well documented in the range SOPs. These include a list of the weapons to be fired at each separate range. While the specific set of weapons may change at a given range area, the set of weapons across the whole site is relatively constant. It is clear that the number and location of the various ranges has changed through the history of the range. For example, in 1983, ranges were reconfigured, renamed, and/or combined with other ranges. In response to this level of change, a comprehensive list of the various range locations has been developed and is presented in Sections 4.1 and 4.3 and attending appendices. These tables include the definition of unique site-locations and description of known historical activities at each location. Maps showing many of these locations are provided in Appendix B. It should be noted that these summaries are based on historic documents to the extent they are available.

The least documented aspect of the use of the facilities at Camp Edwards is the volume of munitions used. Records of munitions use are available for 1989, and 1993 through 1996. These data refer to the general class (e.g., size) of weapon fired. The munitions used in different weapons and the chemical content of these munitions is discussed in the accompanying volume.

The data available for these recent years are likely to represent an underestimate of the rates of munitions use during periods of more intensive base activities such as war-time mobilization. The use of high explosive artillery rounds (105 mm and 155 mm guns) was discontinued in 1995. The use of high explosive mortar rounds was discontinued in 1997. It is likely that the total amount of munitions used at MMR is approximately 200 times the rate of a single year's recent use.

It is possible, based on ongoing clearance of UXO, to estimate the density of UXO within the Impact Area. Based on work to date, there is an average density of UXO of approximately 1 per acre in the more heavily fired upon areas of the Impact Area. The density of UXO is quite variable.

The review of historic archives has been supplemented by a number of interviews with individuals who had access to the base during some portion of the last 50 years. More interviews



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are planned and a public request has been made for persons with knowledge of base activities to come forward. Much of the information obtained in the interviews is consistent with that of the range SOPs (e.g., location of historic ranges, firing activities at historic ranges). In many other cases, historic range practices are detailed that were not included in range SOPs or other historic documents (e.g., waste oil disposal practices, activities at BOMARC, etc.).

The conduct of interviews will continue and reconnaissance tours will be conducted with individuals with in depth knowledge of the Impact Area. Addenda to this document will be issued when the results of these activities are available.

In summary, the archive search has successfully identified a number of historical activities that took place at MMR as well as a number of locations that are not apparent on the 1994 map of the training range. These findings are summarized in a set of tables and in an annotated map of MMR that present unique names for those locations and summarize all of the known historical activities at each one. Despite these findings, the historical record of the post is incomplete. While specific rates of munitions usage at MMR could not be reconstructed, it is estimated that the annual rate of usage was higher, on average, than recent ones. This conclusion is supported by the larger populations present at the post as well as the greater need for training during wartime.

## 6.2 Recommendations

The review of historical range uses has uncovered a number of activities within the Training Range. Some of these (i.e., firing ranges, gun and mortar positions) are essentially similar to activities that were already understood to have occurred but involve previously unknown locations. Such locations should be considered as candidates for further investigation locations but the current investigation means (i.e., sampling and analysis procedures). Other activities are essentially new in nature and may require additional investigation protocols as well as additional sampling locations. The later include disposal of waste oil in troop training areas, disposal pits present at J ranges, and apparent use of depleted uranium in munitions at the J-2 range.

The following are the NGB's recommendations for further investigation of the Impact Area and Training Ranges. The section is organized by type of activity and includes a brief explanation of the potential environmental concern and recommendations on the scope of the investigation.

### 6.2.1 Rocket Ranges

Several ranges were identified where rockets have been or are being used. The potential concern for these areas is that residue from the rocket propellants or explosives may be present in the firing or target areas. NGB recommends that a Response Plan be prepared to investigate one or more representative ranges.

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## 6.2.2 *Small Arms Ranges*

A number of small arms ranges (SAR) have been identified during the archive search. These include currently active SAR, former SAR, and multi-purpose ranges such as the Anti-Tank Gravity Range where 50-cal machine guns were used. These ranges are described in Section 4 and Appendix C. The activities at these ranges typically involve firing into soil berms. It is likely that many of these berms contain a significant quantity of spent bullets. Remediation of these areas will be completed in accordance with an Administrative Order issued by USEPA. The potential concern for these areas is that impacts to groundwater could occur after remediation if metals have already leached into the unsaturated zone, and continue leaching to groundwater. The Army Corps of Engineers study of SAR at MMR by the Waterways Experiment Station (WES) included sampling and analysis of soil from the surface to approximately 90 feet. The WES study predicted migration rates of 2-3 inches per year for metals at MMR, as described in the Action Plan.

NGB recommends that the information for SAR in the Range Use History Report and the Chemical Composition of Munitions Report be evaluated to determine if the ranges studied by WES are representative of SAR that would be expected to have groundwater impacts. If the WES ranges are representative, then NGB proposes that the WES study results be used in conjunction with other data to be developed during the Impact Area Groundwater Study, to determine the potential threat to groundwater. If ranges are identified that could have significantly greater impacts than the SAR studied by WES, then Response Plans to investigate these areas would be developed.

## 6.2.3 *Troop Training and Bivouac Areas*

Several activities have reportedly occurred within the troop training and bivouac areas which could have environmental impacts, including occasional maintenance of heavy vehicles and disposal of waste oils, and regular use of smoke grenades for training purposes. The potential concern for these areas is that impacts to groundwater could occur from waste oil releases or smoke grenade combustion products or residue. These activities are believed to have occurred over wide areas of the training ranges, and while it is possible to observe waste smoke grenades in these areas, it is not possible to identify specific locations for waste oil release based on the current information.

NGB notes that the current investigations underway include groundwater monitoring wells downgradient of much of the training ranges, with analysis of samples for compounds that would be present in waste oil. Therefore, the results of these investigations should indicate whether waste oil release has impacted groundwater quality. NGB recommends that smoke grenade combustion products and residues be determined through "bang box" studies in order to assess the potential impacts of these materials on soil or groundwater.



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## 6.2.4 *J Ranges*

The J-1 range is included in the current investigations insofar as Sites 4 and 5 are associated with this range. Activities have been identified at all three J ranges which could have groundwater impacts, in terms of munitions assembly, firing, and disposal. Textron, which has operated the J-3 range and also used the J-1 range, is currently assembling information on past activities in these areas. NGB is seeking information on the whereabouts or successor companies for Hesse, which operated the J-2 range, and Atlantic Research, which operated the J-1 range, through the Army Corps of Engineers contracting office.

NGB recommends that Response Plans for investigation of the J-2 and J-3 ranges, and any portions of the J-1 range not currently included, be prepared when sufficient information is available from the inquiries that are currently underway. USEPA, MADEP, and the other stakeholders will be kept informed of the progress of these inquiries through the weekly updates and other meetings convened during the Impact Area Groundwater Study.

## 6.2.5 *Demolition Areas*

Boulders were demolished using high explosives at numerous locations along Avery Road, Ben's Hollow Road, and Monument Beach Road during the 1970's, and 5-ton trucks were demolished using high explosives in an area along Wheelock Road east of Turpentine Road in the 1980's. The potential concern for these areas is that residues from demolition materials may be present in soil that could have an impact on groundwater quality.

NGB recommends collection of additional data regarding the sizes of charges and frequencies of activity in these demolition areas, to determine the priority for future investigations. NGB notes that Demo Areas 1 and 2 have been identified as having the highest rates of use based on current information, and these areas are included in the current investigations. Response Plans for the additional demolition areas can be optimized when use rates are known and when preliminary data from the investigations of Demo 1 and 2 are available.

## 6.2.6 *Defoliant Use on Power Lines*

Defoliants were reportedly used by utility companies along power line rights-of-way, which include the western perimeter and northern portion of the Training Ranges and Impact Area. The potential concern for these areas is that excess herbicide may be present in soil or may be transported to groundwater. The current investigation includes ponds located along the western power line (Rod & Gun Club, Donnely Pond, Little Halfway Pond, Deep Bottom Pond), with sampling of surface water and sediment for target analytes including herbicides. The investigation also includes sampling monitoring wells in the areas along the western and northern power lines, including LRWSPAT wells, with analysis for herbicides. NGB recommends that



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response plans for additional investigation of defoliant residue be prepared when data from these preliminary investigations are available.

## 6.2.7 BOMARC Site

Information from interviewees suggests that activity involving radiological materials may have occurred on the ground adjacent to the BOMARC site, and that some visible contaminants were present in surface soil after this site was removed. This information is being turned over to AFCEE for their consideration in the ongoing IRP investigations of this site.

## 6.2.8 Locations from Aerial Photographs

A number of cleared areas, burn areas, and ground scars are visible in aerial photos of the Impact Area, as described in Section 4. These are located throughout the Impact Area. Several of the burn areas, one cleared area, and one ground scar are included in the current investigation. The potential concern with these areas is that the unknown activities at these locations could have impacts on groundwater quality. Interview information and historical data suggest that these areas were not used for munitions firing or targeting. NGB recommends that these areas be the focus of additional data collection through personnel interviews. Response plans for these areas can be optimized when information is available regarding activities performed, and as groundwater quality results for the Impact Area become available.

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## Appendix A. Telephone Call Summaries





## Telephone Call Summary Sheet

**To:** Mr. Jim Carr

**Of:** MMR Headquarters

**Phone:** 508/968-5909

**By:** Mark Gerath, Ogden Environmental

**Re:** Record Keeping Practice on Historic Munitions Use

**Date:** June 3, 1997

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Mr. Carr was a Range Control Officer in the mid-1970s. He currently manages the Ammo Supply Point. I met with him to discuss the availability of historical data on munitions use. He thought that little was available earlier than the 1980s as records are not maintained. I inquired about whether records on the transmittal to the Ammo Supply Point might be available and could be used. He said that those records are also destroyed after a set period of time. In addition, not all of the munitions shipped to ASP are used within the Range Area. Some of the munitions are used at other locations, some is shipped out with mobilizing troops, and other is returned to the source unused during regular purges.

Mr. Carr suggested that we try at the MA National Guard Archive in Worcester (508/797-0334).

He recalled that the old Range A (with the Gravity Anti-tank Range) was located off Wood Rd. Firing was into the hill to the Northeast.

He believes that munitions materials are essentially the same in composition now as they were in the previous decades.

## Telephone Call Summary Sheet

**To:** Sergeant Marble  
**Of:** MMR Headquarters  
**Phone:** 508/968-5971  
**By:** Mark Gerath, Ogden Environmental  
**Re:** Record Keeping Practice on Historic Munitions Use  
**Date:** June 25, 1997

---

I called Sergeant Marble to inquire about record keeping practice and requirements at MMR. In particular what are the requirements for maintenance of Air Space Utilization Reports. Sergeant Marble said that the length of storage of different document types is specified in the Modern Army Record Keeping System (MARKS). This is an Army regulation most recently updated in 1993. An earlier system (the Army Functional Files System), had essentially the same requirements. Sergeant Marble believed that the earlier system would have been in use for decades.

Sergeant Marble agreed to find the MARKS code for the Air Space Utilization Reports and call me back with the storage requirements.

She called back and said that Air Space Utilization Reports were classified under MARKS as 385-10G and consist of the information on the firing range, the number of rounds fired, the unit involved, the number of people in the unit, and safety measures taken. Under the MARKS system, these records may be destroyed after one year.



## Telephone Call Summary Sheet

**To:** Stephen Seames  
**Of:** MA National Guard Archive and Library  
**Phone:** 508/787-0334  
**By:** Mark Gerath, Ogden Environmental  
**Re:** Historic Munitions Use and Base Population  
**Date:** June 25, 1997

---

The National Guard Archive has been in existence from 1994. It contains a tremendous amount of material on the MA National Guard including such things as service files, etc. Most of the material has yet to be sorted. Access to the archive is by appointment and permission must be obtained from Major Crivello at Facilities Management in Milford (508/233-6551).

Mr. Seames thought that it was unlikely that information on munitions use would be present at the archive. He said that in 1902 with the passage of the Dick Act the MA Guard was federalized and munitions supply (among other processes) was taken over by the Federal Government. The archive only contains materials that are specific to the instate operations of the MA National Guard.

He thought information on base population may be accessible in the annual report of the National Guard Adjutant General. These are public documents and should be available in the MA State Library. He knows that these reports have information on the level of training activity at MMR and elsewhere.

## Telephone Call Summary Sheet

**To:** Staff Sergeant Spilhaus  
**Of:** Explosive Ordnance Disposal, MMR  
**Phone:** 508/968-4861  
**By:** Mark Gerath, Ogden Environmental  
**Re:** Potential Depth of UXO  
**Date:** July 1, 1997

---

Staff Sergeant Spilhaus is a specialist in the disposal of unexploded ordnance. He believes that there is no legitimate "rule-of-thumb" regarding the maximum depth of encounter of UXO. He said that a 90 pound shell (for example) has a significant ability to penetrate the ground. This is exacerbated by the fact that new materials can be deposited on top of the ground surface by a variety of human activities (e.g., explosion of shells, road building, etc.) He also said that shells can behave in unusual ways such as "dolphining" by penetrating deep and returning to the surface. He said it was safe to say that no UXO would be found at 50 feet below grade.

## Telephone Call Summary Sheet

**To:** Jim Tanin  
**Of:** Textron Systems Corporation  
**Phone:** 508/657-3691  
**By:** Mark Gerath, Ogden Environmental  
**Re:** Textron's Activities at MMR  
**Date:** June 25, 1997

---

Mr. Tanin had prepared a written summary of recent Textron activities at the J-3 range at MMR. I called him to inquire whether he had information on historical activities by Textron. He said that his summary reflects the activity at J-3 during the last 10 to 12 years, the period he has been working at Textron. It is difficult to access information on Textron's activities prior to that period as staff have turned over. It is his belief that the general level of activities (i.e., approximately weekly testing of single explosive round) was likely to have occurred before his tenure at Textron.

Mr. Tanin has been in charge of negotiating the lease between the National Guard Bureau and Textron. He understood that Textron had, at one time, an agreement to use the J-1 range as well as J-3. He is unaware of the type of activities that occurred there and said it is a possibility that only an access agreement was in place and no actual testing occurred.

Mr. Tanin said that he would attempt to access more information by looking through files and talking to his colleagues.



## Telephone Call Summary Sheet

**To:** Tom Walch

**Of:** US Army, Picatinny Arsenal

**Phone:** 201/724-6463

**By:** Mark Gerath, Ogden Environmental

**Re:** Estimates of Dud Rates in Howitzer and Mortar Shells

**Date:** July 10, 1997

---

Mr. Walch works in the development of mortar rounds. He looked up the technical specification of two mortar rounds likely to be used at MMR and said that the required rate of successful denotation was 99% for both. This suggests that, at the point of manufacturing and shipping, the dud rate is less than one percent. He discussed specifications for howitzer shells with one of his colleagues and he said they have required rates of successful detonation on the order of 98% to 99%.

Mr. Walch noted that long-term (e.g., 10 years or more) will result in a higher rate of duds. He believed that a reasonable rule-of-thumb for dud rate, considering long-term storage, was on the order of two percent.







# **DRAFT RANGE USE HISTORY REPORT**

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## **Appendix B. Historical Range Maps**

**MAP 1: SKETCH OF 1941 TRAINING RANGE**

**MAP 2: 1994 TRAINING RANGE MAP**

**MAP 3: 1949 TRAINING RANGE MAP**

**MAP 4: 1949 TRAINING RANGE MAP SHOWING RANGE FANS**

**MAP 5: 1979 TRAINING RANGE MAP**

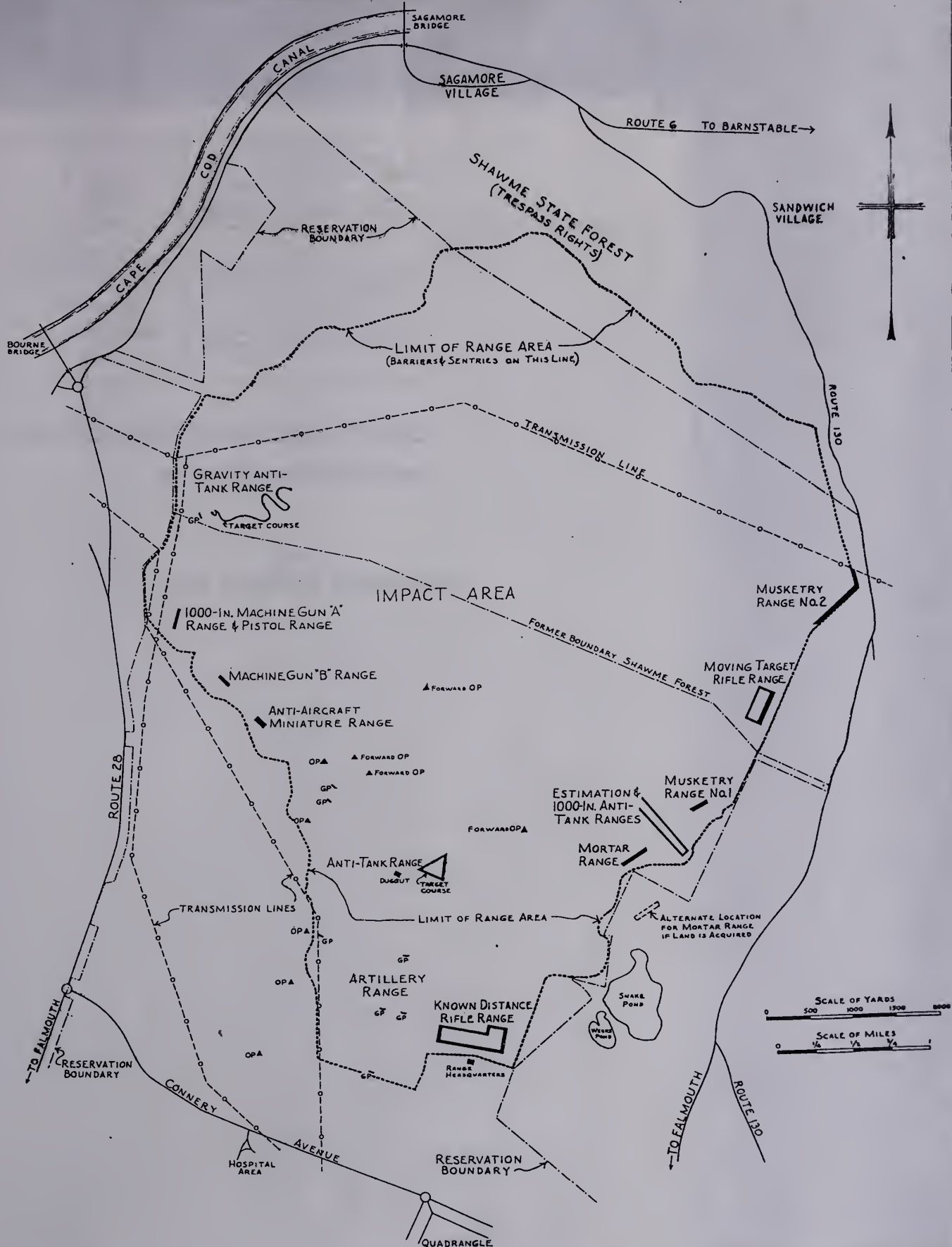
**MAP 6: 1986 TRAINING RANGE MAP**

**MAP 7: 1991 MAP SHOWING TRAINING RANGE ACTIVITIES**

**MAP 8: MAP ANNOTATED TO INDICATE HISTORICAL LOCATIONS**

**TABLE B-1. LIST OF MMR SITES REFERENCED TO MAP 8**





LEGEND:  
GP - ARTILLERY GUN POSITION  
OP - OBSERVATION POST

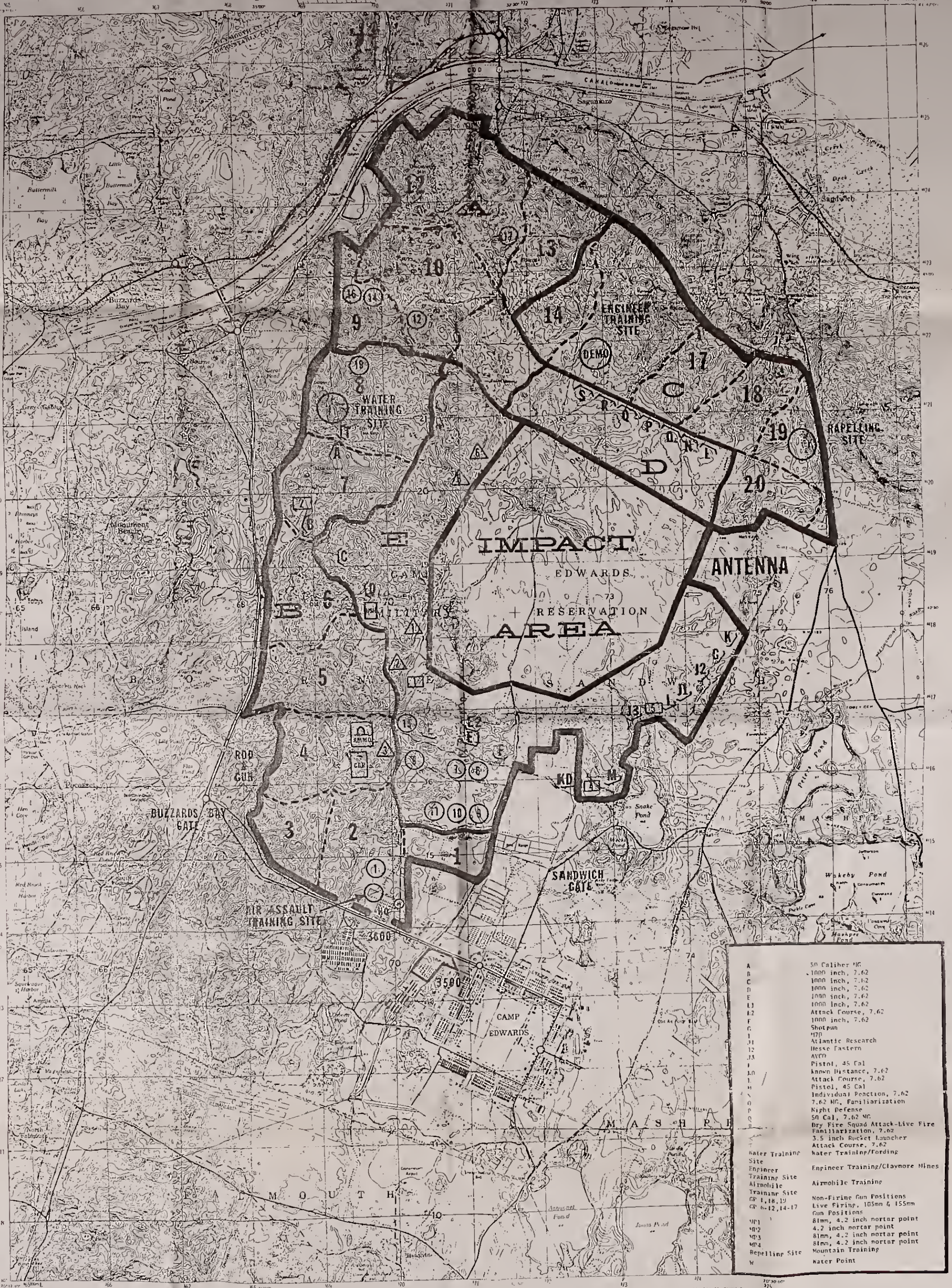
RANGES NOT SHOWN ON THIS MAP:  
ANTI-AIRCRAFT RANGE - AT SCORTON NECK  
BAYONET QUALIFICATION COURSES  
DUMMY GRENADE COURTS  
LIVE GRENADE COURTS

SOUTH OF  
QUADRANGLE

MAP 1:  
SKETCH OF 1941 TRAINING  
RANGE







A	50 Caliber MG
B	1000 inch, 7.62
C	1000 inch, 7.62
D	1000 inch, 7.62
E	1000 inch, 7.62
F	1000 inch, 7.62
G	Attack Course, 7.62
H	1000 inch, 7.62
I	Shotgun
J	AT
K	Atlantic Research
L	Hesse Eastern
M	AVCO
N	Pistol, 45 Cal
O	known Distance, 7.62
P	Attack Course, 7.62
Q	Pistol, 45 Cal
R	Individual Penetration, 7.62
S	7.62 MG, Familiarization
T	Night Defense
U	50 Cal, 7.62 MG
V	Dry Fire Squad Attack-Live Fire
W	Familiarization, 7.62
X	3.5 inch Rocket Launcher
Y	Attack Course, 7.62
Z	Water Training/Fording
AA	Engineer Training/Claymore Mines
AB	Airmobile Training
AC	Non-Fire Gun Positions
AD	Live Firing, 105mm & 155mm
AE	Gun Positions
AF	81mm, 4.2 inch mortar point
AG	4.2 inch mortar point
AH	81mm, 4.2 inch mortar point
AI	81mm, 4.2 inch mortar point
AJ	Mountain Training
AK	Water Point

LEGEND

Scale 1:25,000

TRANSVERSE MERCATOR PROJECTION

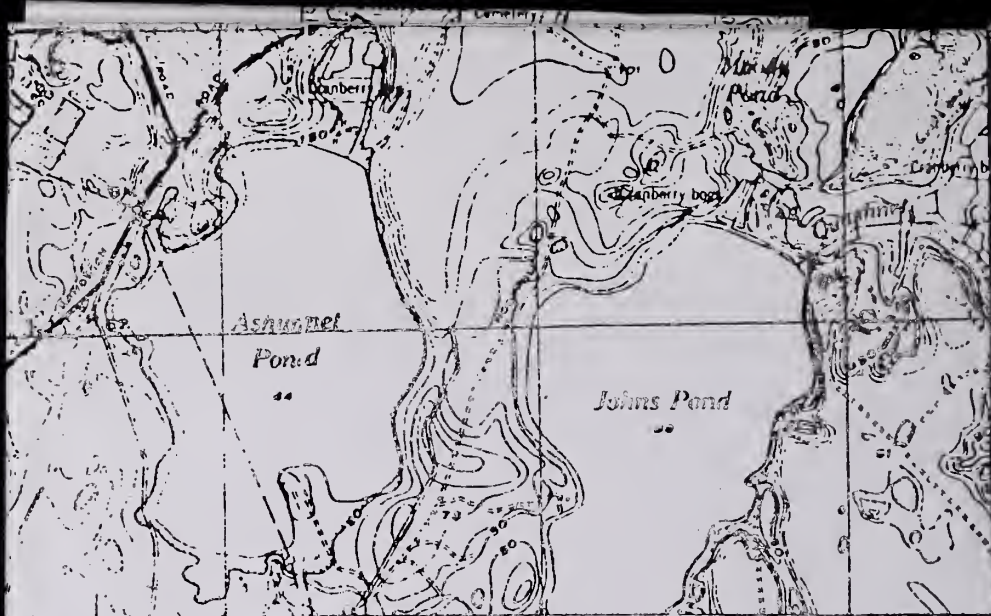
CAUTION

This map is an emergency edition. No attempt has been made to adjust fold match between the mosaiced sheets forming the map.

MAP 3:  
1949 TRAINING RANGE MAP

CAMP EDWARDS, MASSACHUSETTS  
CAMP EDWARDS AND VICINITY  
N81375 W00251010





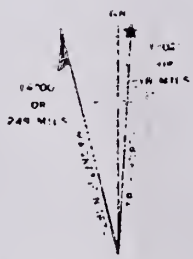
S  
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 GP  
 MP  
 MP  
 MP  
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 W

SX12-60 PRINTED BY ARMY MAP SERVICE, CORPS OF ENGINEERS

1 Mile  
 1:50,000  
 1:50,000  
 1:50,000

**CAUTION**

This map is an emergency edition. No attempt has been made to adjust detail match between the mosaicked sheets forming the map.

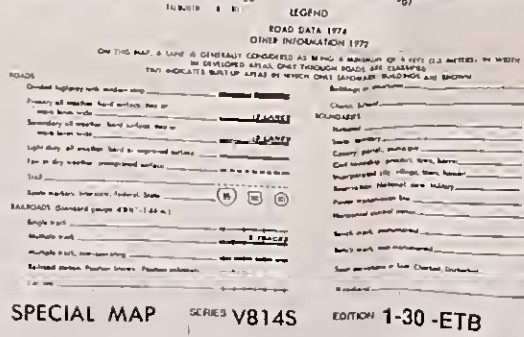


APPROXIMATE MEAN DECLINATION IN DEGREES  
 (BASED ON 1950)

Use diagram only to obtain numerical values. To determine magnetic north line, connect the great circle "P" on the south edge of the map with the value of the angle between GRID NORTH and MAGNETIC NORTH as plotted on the diagram scale at the north edge of the map.

CAMP EDWARDS, MASSACHUSETT  
 CAMP EDWARDS AND VICINITY  
 N4137 E W7025 S 19 E 1 P





CONTOUR INTERVAL 10 FEET

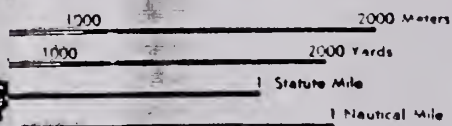
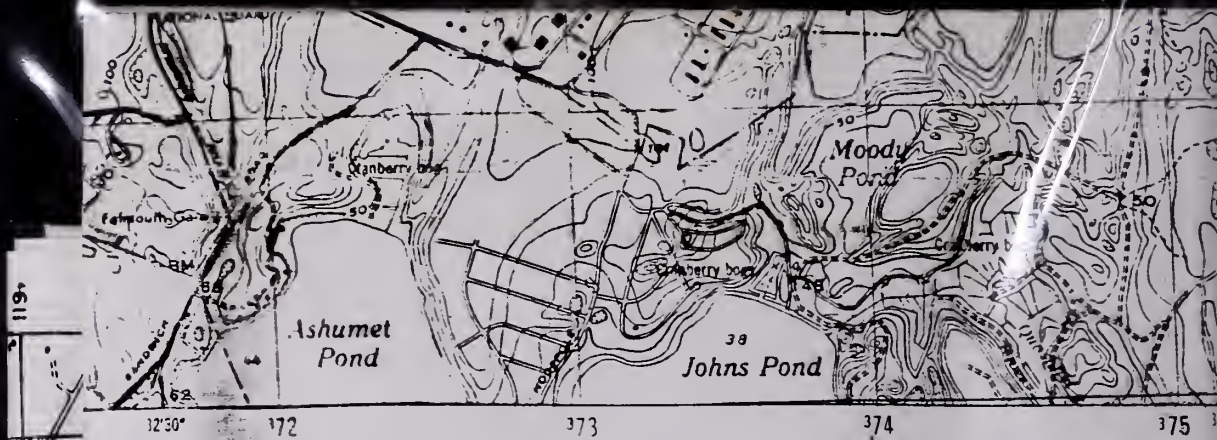
SPEEED	CLARKS
GRADE	1000 AFTER UTM ZONE 18
REDUCTION	PLACEMENT
VERTICAL DATUM	SEA LEVEL DATUM
HORIZONTAL DATUM	1973
CONT. #1	USGS AND

PREPARED BY THE 15TH ENGINEER COMPANY  
30TH ENGINEER BATTALION (TOPG) (ARMY)  
20TH ENGINEER BRIGADE (C&T) (ABIG)  
FORT BRAGG, NORTH CAROLINA 28307-5000  
AUGUST 1994

[illegible]

STOCK NO. VB14SPEDWARD





10 FEET

SCALE 1:60,000  
 TRANSVERSE MERCATOR  
 SEA LEVEL DATUM 1929  
 1977 NAD  
 30S AND 40S  
 179

- (A) Range Location
- △ OP Observation Post
- ⊙ GP Gun Position
- ⊗ MP Mortar Position

1975  
 G-M ANGLE  
 15° 30' (267 MILS)

GRID CONVERGENCE  
 7° 02' (12 MILS)  
 FOR CENTER OF SHEET

TO CONVERT A  
 GRID AZIMUTH TO A  
 MAGNETIC AZIMUTH  
 ADD G-M ANGLE

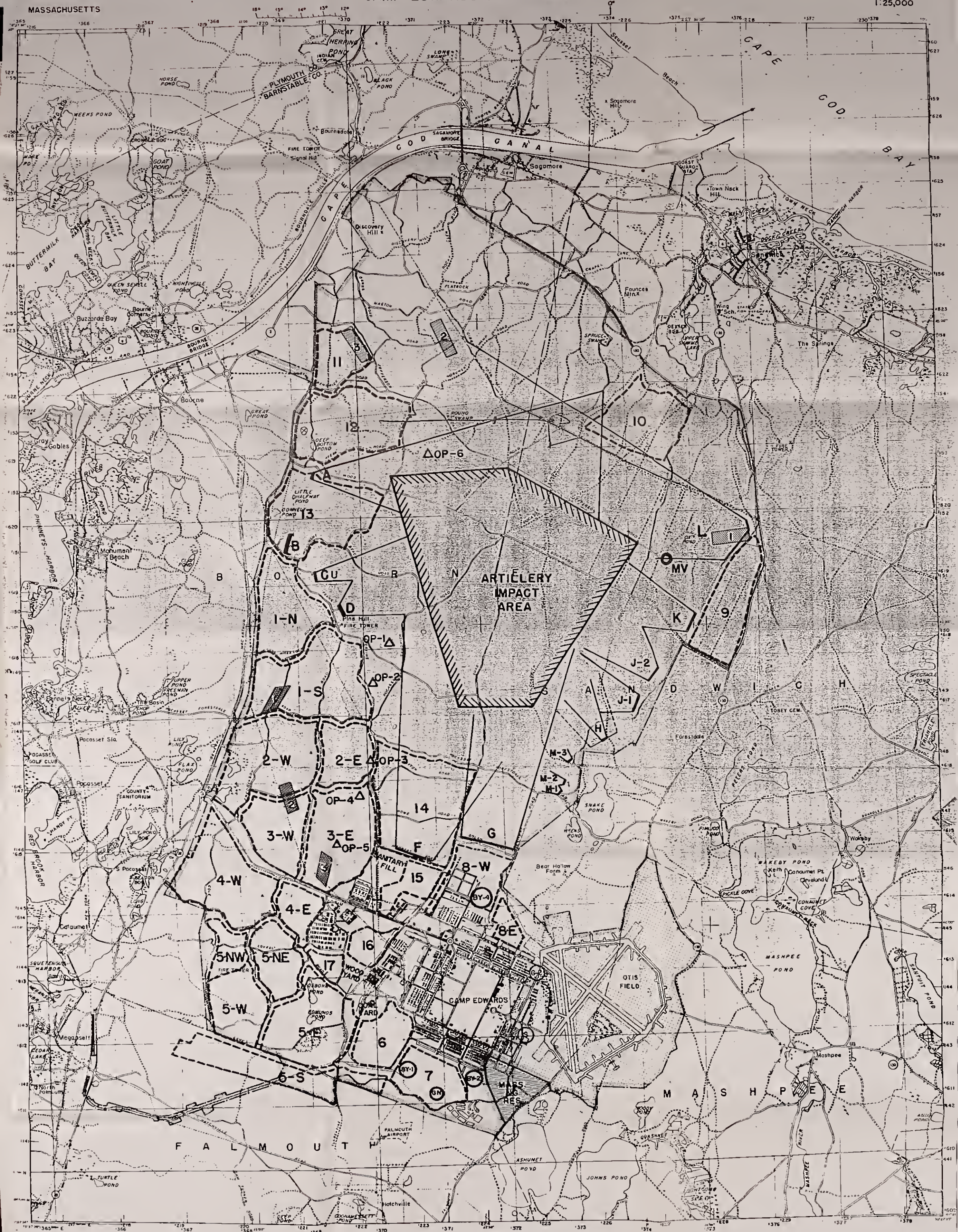
TO CONVERT A  
 MAGNETIC AZIMUTH  
 TO A GRID AZIMUTH  
 SUBTRACT G-M ANGLE



# CAMP EDWARDS AND VICINITY

1:25,000

MASSACHUSETTS



COMPILED FROM ARMY MAP SERVICE, 1:25000 POCASSET 1943,  
SAGAMORE 1942, SANDWICH 1942 AND 1:31850 USGS  
CONTUIT 1939.  
MILITARY RESERVATION BOUNDARIES AS OF MAY 1, 1949  
COMPILED BY FIRST ARMY ENGINEER,  
INTELLIGENCE DIVISION,  
GOVERNORS ISLAND, N.Y.

Scale 1:25000

MAY 12, 1949

TRANSVERSE MERCATOR PROJECTION  
1327 NORTH AMERICAN DATUM

ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 19  
NUMBERED TICKS INSIDE THE HEATLINE INDICATE THE  
1000 YARD U.S. POLYCONIC GRID ZONE A  
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

CAMP EDWARDS & VICINITY  
N4137.54W7027.510

5-005

















Date of Report March 19

James H. Jones, Jr.  
President

Chemery, Inc.  
Engineers, Inc.



**Table B-1**  
**List of MMR Sites Referenced to Map 8**

Map 8 Reference Number	Name	Function	Location
1	A	Practice Range	Burgoyne Rd.
2	B	Practice Range	Burgoyne Rd.
3	C	Practice Range	Burgoyne Rd.
4	D	Practice Range	Burgoyne Rd.
5	Demo 1	Demolition Range	Pocasset-Forestdale Rd.
6	Demo 2	Demolition Range	off Gibbs Rd.
7	E	Combat Pistol Qualification	Burgoyne Rd.
8	G	Practice Range	Pocasset-Forestdale Rd.
9	H	Practice Range	Pocasset-Forestdale Rd.
10	I	Practice Range	Pocasset-Forestdale Rd.
11	IBC	Infantry Battle Course	Gibbs Rd.
12	J	Practice Range	Pocasset-Forestdale Rd.
13	K	Practice Range	Pocasset-Forestdale Rd.
14	KD	Multi-purpose Range	Pocasset-Forestdale Rd.
15	CTR-1/M31	Practice Range	Pocasset-Forestdale Rd.
16	L	Practice Range	Greenway Rd.
17	N	Practice Range	Greenway Rd.
18	O	Practice Range	Greenway Rd.
19	P	Practice Range	Greenway Rd.
20	S-EAST	Transition Range	Gibbs Rd.
21	S-WEST	Transition Range	Gibbs Rd.
22	T	Practice Range	Gibbs Rd.
23	U	Rocket Launcher	Gibbs Rd.
24	J-3	Test Range	Greenway Rd.
25	J-1-inactive	Practice Range	Greenway Rd.
26	M-inactive	Practice Range	Greenway Rd.
27	Q-inactive	Practice Range	Gibbs Rd.
28	R-inactive	Practice Range	Gibbs Rd.
29	MT-inactive	Practice Range	Greenway Rd., north of Wood Rd.
30	Mus-2-inactive	Practice Range	Greenway Rd., north of Jefferson Rd.
31	MV-inactive	Mock Village	Jefferson Rd., south of Ox Pond
32	Old-A	Anti Tank Gravity Range	Woods Rd.
33	Old-B	Practice Range	Frank Perkins Rd.
34	Old-C	Practice Range	Frank Perkins Rd.
35	Old-D	Practice Range	Frank Perkins Rd.
36	G-A/G-B-inactive	Practice Range	north side of Dolan Rd.
37	GN-1-inactive	Grenade Range	Howe Rd., junction Frank Perkins Rd.
38	GN-2-inactive	Grenade Range	Howe Rd., junction Frank Perkins Rd.
39	Old-H	Practice Range	Greenway Rd., adjacent to 1
40	Old-N	Practice Range	Gibbs Rd.
41	Old-O	Practice Range	Gibbs Rd.
42	Old-R	Practice Range	Gibbs Rd.
43	GP-1-inactive	Gun Position	Stowell Rd.
44	GP-2	Gun Position	Frank Perkins Rd.
45	GP-3-inactive	Gun Position	Howe Rd.
46	GP-4-inactive	Gun Position	Howe Rd.
47	GP-5	Gun Position	Howe and Frank Perkins Rds.
48	GP-6	Gun Position	Mitton Rd.
49	GP-7	Gun Position	Mitton Rd.
50	GP-8	Gun Position	Mitton Rd.
51	GP-9	Gun Position	Howe Rd.

Map 8 Reference Number	Name	Function	Location
52	GP-10	Gun Position	Howe Rd.
53	GP-11	Gun Position	Howe Rd.
54	GP-12	Gun Position	Cataumet Rd.
55	GP-14	Gun Position	Jefferson Rd.
56	GP-15-inactive	Gun Position	Pocasset-Forestdale Rd.
57	GP-16	Gun Position	Jefferson Rd.
58	GP-17	Gun Position	Flatrock Rd.
59	GP-18	Gun Position	Flatrock Rd.
60	GP-19-inactive	Gun Position	Kendrick Rd.
61	GP-20	Gun Position	Off Cataumet Rd.
62	GP-22	Gun Position	Monument Swamp Rd.
63	GP-24	Gun Position	Wheelock Rd.
64	GP-2-old	Gun Position	South of Herbert Rd.
65	GP-3-old	Gun Position	South of Herbert Rd.
66	GP-4-old	Gun Position	North of Dolan Rd.
67	MP-1	Mortar Point	Pocasset-Forestdale Rd.
68	MP-2	Mortar Point	Pocasset-Forestdale Rd.
69	MP-3	Mortar Point	Pocasset-Sandwich Rd.
70	MP-4	Mortar Point	Pocasset-Sandwich Rd.
71	MP-5	Mortar Point	Pocasset-Sandwich Rd.
72	MP-6	Mortar Point	Pocasset-Sandwich Rd.
73	MP-7	Mortar Point	Pocasset-Sandwich Rd.
74	MP-8	Mortar Point	Off Pocasset-Sandwich Rd.
75	MP-9-inactive	Mortar Point	Off Gibbs Rd.
76	MP/OP 1-inactive	Mortar Point	Off Pocasset-Sandwich Rd.
77	MP-2-old	Mortar Point	Off Monument Beach Rd.
78	MP-3-old	Mortar Point	Wood Rd.
79	Round Swamp	Water Body	Burgoyne Rd., north of Impact Area
80	Grassy Pond	Water Body	Gibbs Rd.
81	Ox Pond	Water Body	E. Jefferson Rd.
82	Succonsette Pond	Water Body	Off Pocasset-Sandwich Rd., Impact Area
83	Opening Pond	Water Body	Off Pocasset-Forestdale Rd.
84	Deep Bottom Pond	Water Training Site	Deep Bottom Pond Rd., north of Wood Rd.
85	Donnelly Pond	Water Body	Off Canalview Rd., west of Impact Area
86	Site 1	Target Area	Turpentine Rd., Impact Area
87	Site 2	Target Disposal Area	Off Pocasset-Sandwich Rd., Impact Area
88	Site 3	Target Area	South of Five Corners, Impact Area
89	Site 4	Target Area	Tank Alley, Impact Area
90	Site 5	Target Area	Southeast corner of Impact Area
91	Site 6	Vehicle and supplies staging area	Monument Beach Rd., Impact Area edge
92	CBR Site	Indoor tear gas and smoke training	Estey Rd.
93	BOMARC	Air defense missile system	Dolan Rd.
94	Dropped Darts	Air-to-air target darts	along Turpentine Rd.
95	Demo-3	Demolition of boulders	along Avery, Ben's Hollow and Monument Beach Rds.
96	Demo-4	Demolition of 5-ton trucks	Wheelock, east of Turpentine
97	Power Lines	Defoliant use on right-of-way	Many (see Range Maps)
98	Rod & Gun Club	Sport Shooting Practice Range	Connery Ave. at Route 28
99	Engineer Training Site	Engineer Training	South of Spruce Swamp







# DRAFT RANGE USE HISTORY REPORT

■ ■ ■ ■ ■

## Appendix C. Summary of Known Activities at Firing Ranges





## Summary of Known Activities at Range A

Current Designation: A

Former Designation - Date of Change:

Location (Narrative): Burgoyne Rd.

Location (Coordinates): CS 70502046

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 1

Historic Activities	Dates	Source
.50 cal. ball, MG	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
.50 cal. tracer, MG	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
.50 cal. plastic, MG	Sep '91	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range A

Current Designation: A

Former Designation - Date of Change:

Location (Narrative): Burgoyne Rd.

Location (Coordinates): CS 70502046

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 1

Historic Activities	Dates	Source
.50 cal. ball, MG	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
.50 cal. tracer, MG	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
.50 cal. plastic, MG	Sep '91	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range B

Current Designation: B

Former Designation - Date of Change:

Location (Narrative): Burgoyne Rd.

Location (Coordinates): CS 70362023

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 2

Historic Activities	Dates	Source
5.56 mm ball and tracer	Feb '90 - Mar '94	Range and Training Facilities, Camp Edwards
pistol, all calibers	Feb '90 - Mar '94	Range and Training Facilities, Camp Edwards
rifle, MG (proposed)	Feb '89	Range and Training Facilities, Camp Edwards
.50 cal. MG	unknown	Interview - Zanis

## Summary of Known Activities at Range C

Current Designation: C

Former Designation - Date of Change:

Location (Narrative): Burgoyne Rd.

Location (Coordinates): CS 70262001

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 3

Historic Activities	Dates	Source
5.56 mm ball, rifle	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
5.56 mm tracer	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range D

Current Designation: D

Former Designation - Date of Change:

Location (Narrative): Burgoyne Rd.

Location (Coordinates): CS 70201984

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 4

Historic Activities	Dates	Source
7.62 ball, M60 MG	Feb '89	Range and Training Facilities, Camp Edwards
7.62 ball, MG	Feb '90 - Mar '94	Range and Training Facilities, Camp Edwards
7.62 tracer, MG	Sep '91 - Mar '94	Range and Training Facilities, Camp Edwards



## Summary of Known Activities at Range Demo 1

Current Designation: Demo 1

Former Designation - Date of Change: Anti-Tank Range - after 1941, E-1 - May 1970, E-2 - Feb. 1989

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 71091669

Basic Function: Demolition Range

Maps/sketches/photos: Appendix D

Map Reference Number: 5

Historic Activities	Dates	Source
37mm and 75mm guns	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
50 cal. MG	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
30 cal. and 7.62mm ball	Feb '67 - May '70	Range Safety Regulations, Camp Edwards
rifle squad in attack	Aug '68 - May '70	Range Safety Regulations, Camp Edwards
blanks, not to exceed 7.62mm (not to exceed 40 lbs.):	Jul '73	Range Safety Regulations, Camp Edwards
C-4	Feb '81 - Mar '94	Range Safety Regulations, Camp Edwards
TNT	Feb '81 - Mar '94	Range Safety Regulations, Camp Edwards
dynamite	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
shape charges	Feb '81 - Mar '94	Range Safety Regulations, Camp Edwards
cratering charges	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
bangalore torpedoes	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
clay-more mines	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
detonating cord, no > 40 lbs.	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
large quantities of C4, confiscated fireworks, and munitions visible on surface		Interview - Zanis
filled historic pond	after 1988	Interview - Zanis

## Summary of Known Activities at Range Demo 2

Current Designation: Demo 2

Former Designation - Date of Change: E-3 - Feb. 1989

Location (Narrative): off Gibbs Rd.

Location (Coordinates): CS 73022168

Basic Function: Demolition Range

Maps/sketches/photos:

Map Reference Number: 6

Historic Activities	Dates	Source
<i>(not to exceed 10 lbs.):</i>		
C-4	Feb '81 -Mar '94	Range Safety Regulations, Camp Edwards
TNT	Feb '81 -Mar '94	Range Safety Regulations, Camp Edwards
shape charges	Feb '81 - Nov '83	Range Safety Regulations, Camp Edwards
claymore mines	Feb '81 -Mar '94	Range Safety Regulations, Camp Edwards
dynamite	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
detonating cord	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards

### Summary of Known Activities at Range E

Current Designation: E

Former Designation - Date of Change:

Location (Narrative): Burgoyne Rd.

Location (Coordinates): CS 70221974

Basic Function: Combat Pistol Qualifications

Maps/sketches/photos:

Map Reference Number: 7

Historic Activities	Dates	Source
.45 cal. and .38 cal., 9 mm ball	Feb '89	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range G

Current Designation: G

Former Designation - Date of Change: E - Feb. 1989

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 7046166

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 8

Historic Activities	Dates	Source
submachine gun, cal. 45	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
submachine gun, 9mm	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
shotgun	FY '89 - Mar '94	Env. Management Analysis Program for MMR, 1991
7.62mm ball	May '70 - May '94	Range Safety Regulations, Camp Edwards
30 cal. ball	May '70	Range Safety Regulations, Camp Edwards
5.56mm ball	Nov '83 - Mar '94	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm tracer	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
light MG	May '70	Range Safety Regulations, Camp Edwards
rifle	May '70 - Mar '94	Range Safety Regulations, Camp Edwards
MG	Nov '83 - Mar '94	Range Safety Regulations, Camp Edwards
M27 SAW	Feb '90	Range Safety Regulations, Camp Edwards
M249 SAW	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range H

Current Designation: H

Former Designation - Date of Change: E - Aug. 1968, E-1 - Feb. 1989

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 71061650

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 9

Historic Activities	Dates	Source
MG .50 cal. M-2	Oct '53	Range Safety Regulations, Camp Edwards
2.36 and 3.5 rocket launcher	Oct '53	Range Safety Regulations, Camp Edwards
platoon live fire	Nov '59 - Jan '65	Range Safety Regulations, Camp Edwards
transition for BAR, submachine guns, MG	Jan '65	Range Safety Regulations, Camp Edwards
light MG	Feb '67 - Jul '73	Range Safety Regulations, Camp Edwards
automatic rifle	Feb '67 - May '70	Range Safety Regulations, Camp Edwards
30 cal. ball	Feb '67 - May '70	Range Safety Regulations, Camp Edwards
7.62mm ball	Feb '67 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm ball	Jan '79 - Mar '94	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm tracer	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
rifle	May '70 - Mar '94	Range Safety Regulations, Camp Edwards
MG	Jul '73 - Mar '94	Range Safety Regulations, Camp Edwards
M60 MG (.38, .45 cal., 9mm)	FY '89	Env. Management Analysis Program for MMR, 1991
pistol, all calibers	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
submachine gun, cal. .45	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
submachine gun, 9mm	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range I

Current Designation: I

Former Designation - Date of Change: F - Feb. 1989

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 71541628

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 10

Historic Activities	Dates	Source
carbine	Jul '65	Range Safety Regulations, Camp Edwards
rifle	Jan '65 - Jul '73	Range Safety Regulations, Camp Edwards
30 cal. and 7.62mm	Feb '67 - May '70, Feb '81 - Feb '89	Range Safety Regulations, Camp Edwards
field artillery	Nov '59	SOP, Camp Edwards
mortar	Nov '59	SOP, Camp Edwards
5.56mm ball and tracer	Feb '90	Range Safety Regulations, Camp Edwards
5.56mm rifle and SAW, ball and tracer	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
submachine gun, cal. 45	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
submachine gun, 9mm	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
shotgun	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range IBC

Current Designation: IBC

Former Designation - Date of Change:

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 73202113

Basic Function: Infantry Battle Course

Maps/sketches/photos:

Map Reference Number: 11

Historic Activities	Dates	Source
platoon-size live fire attack course	Feb '82	Change 3 to Camp Edwards Regulation
5.56mm and 7.62 ball	Feb '82	Change 3 to Camp Edwards Regulation
refer to IBC plan	Nov '83 - Mar '94	Range Safety Regulations, Camp Edwards
LAW rockets		Interview - Zanis

## Summary of Known Activities at Range J

Current Designation: J

Former Designation - Date of Change:

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 71951612

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 12

Historic Activities	Dates	Source
shotgun	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm rifle and SAW, ball and tracer	Sept '91 - Mar '94	Range Safety Regulations, Camp Edwards
MG up to 7.62mm	Sep '91	Range Safety Regulations, Camp Edwards
submachine gun, .45 cal. and 9mm	Mar '94	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range K

Current Designation: K

Former Designation - Date of Change:

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 72041611

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 13

Historic Activities	Dates	Source
shotgun	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm ball and tracer	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm rifle and SAW, ball and tracer	Mar '94	
submachine gun, cal .45	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
submachine gun, 9mm	Mar '94	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range KD

Current Designation: KD

Former Designation - Date of Change:

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 72241600

Basic Function: Multi-purpose Range

Maps/sketches/photos:

Map Reference Number: 14

Historic Activities	Dates	Source
shotgun	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm ball	Nov '83 - Feb '90	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm tracer	Feb '90	Range Safety Regulations, Camp Edwards
7.62mm MG and rifle, ball and tracer	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm rifle and SAW, ball and tracer	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
M371 HEAT, M371E1	Feb '89 - Feb '90	Range Safety Regulations, Camp Edwards
M183 PD, 40mm practice	Feb '89	Range Safety Regulations, Camp Edwards
Dragon, M222 HEAT, M223 practice	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
90 mm	Feb '90	Range Safety Regulations, Camp Edwards
90mm RR HEAT and practice	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
M31 FA Trainer with M183	Sept '91 - Mar '94	Range Safety Regulations, Camp Edwards
TOW, inert warhead	Sept '91 - Mar '94	Range Safety Regulations, Camp Edwards
submachine gun, .45 and 9mm	Mar '94	Range Safety Regulations, Camp Edwards
rockets		Interview - Zanis
tank gunnery		Interview - Zanis

## Summary of Known Activities at Range KD

Current Designation: KD

Former Designation - Date of Change:

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 72241600

Basic Function: Multi-purpose Range

Maps/sketches/photos:

Map Reference Number: 14

Historic Activities	Dates	Source
shotgun	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm ball	Nov '83 - Feb '90	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm tracer	Feb '90	Range Safety Regulations, Camp Edwards
7.62mm MG and rifle, ball and tracer	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm rifle and SAW, ball and tracer	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
M371 HEAT, M371E1	Feb '89 - Feb '90	Range Safety Regulations, Camp Edwards
M183 PD, 40mm practice	Feb '89	Range Safety Regulations, Camp Edwards
Dragon, M222 HEAT, M223 practice	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
90 mm	Feb '90	Range Safety Regulations, Camp Edwards
90mm RR HEAT and practice	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
M31 FA Trainer with M183	Sept '91 - Mar '94	Range Safety Regulations, Camp Edwards
TOW, inert warhead	Sept '91 - Mar '94	Range Safety Regulations, Camp Edwards
submachine gun, .45 and 9mm	Mar '94	Range Safety Regulations, Camp Edwards
<i>Rockets</i>		<i>Interview - Zamis</i>
<i>Tank gunnery</i>		<i>Interview - Zamis</i> ✓

## Summary of Known Activities at Range CTR-1/M31

Current Designation: CTR-1/M31

Former Designation - Date of Change: .

Location (Narrative): Pocasset-Forestdale Rd.

Location (Coordinates): CS 722159

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 15

Historic Activities	Dates	Source
40mm (practice)	Nov '83	Range Safety Regulations, Camp Edwards
7.62mm ball and tracer	Nov '83	Range Safety Regulations, Camp Edwards
14.5mm M183PD	Nov '83	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range L

Current Designation: L

Former Designation - Date of Change: I - Feb. 1989

Location (Narrative): Greenway Rd.

Location (Coordinates): CS 73401694

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 16

Historic Activities	Dates	Source
Infiltration Course	Oct '53	Range Safety Regulations, Camp Edwards
.30 cal. and 7.62mm, rifle	Feb '67 - May '70	Range Safety Regulations, Camp Edwards
5.56mm rifle	Feb '81, Nov '83,	Range Safety Regulations, Camp Edwards
M-79 and M-203 grenade launcher	Feb '81 - Feb '90	Range Safety Regulations, Camp Edwards
M79 grenade launcher (practice)	Jul '73	Range Safety Regulations, Camp Edwards
M203 grenade launcher	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
40mm practice	Feb '81 - Mar '94	Range Safety Regulations, Camp Edwards
40mm HE	Feb '81	Range Safety Regulations, Camp Edwards
30 cal. MG M60	May '70	Range Safety Regulations, Camp Edwards
shotgun	May '70	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range N

Current Designation: N

Former Designation - Date of Change: Musketry Range No.1 - Oct. '43, Transition Range - Oct '53, J-2 - Feb. 1989

Location (Narrative): Greenway Rd.

Location (Coordinates): CS 74181753

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 17

Historic Activities	Dates	Source
musketry	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
rifles	Oct '43	Training Center Regulations, Camp Edwards
shotgun	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm ball	Nov '83 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm tracer	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
rifle M-1 cal. .30	Oct '53	Range Safety Regulations, Camp Edwards
carbine cal. .30	Oct '53	Range Safety Regulations, Camp Edwards
testing	Nov '83	Range Safety Regulations, Camp Edwards
Lincoln Labs, research on 60mm mortars		Interview - Zanis
Hesse Eastern research, used 105mm and depleted uranium rounds		Interview - Nelson
shaped charge assembly at bunkers		Interview - Zanis
and disposal in pits here or J-1		
use of carbon disulfide as cleaning solvent here or J-1		Interview - Zanis
discolored runoff observed from a shed		Interview - Nelson
Hesse developed M79 (M203) grenade launcher, 81mm mortar		Interview - Manfreidy
metal debris burial here or J-1 or J-3		Interview - Manfreidy

## Summary of Known Activities at Range O

Current Designation: O

Former Designation - Date of Change: G - Feb. 1989

Location (Narrative): Greenway Rd.

Location (Coordinates): CS 74601774

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 18

Historic Activities	Dates	Source
shotgun	Jul '73 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, all calibers	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
pistol, 9mm only	Feb '90	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range P

Current Designation: P

Former Designation - Date of Change: K - Feb. 1989

Location (Narrative): Greenway Rd.

Location (Coordinates): CS 74641783

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 19

Historic Activities	Dates	Source
3.5 rocket launcher	Oct '53 - Feb '67	Range Safety Regulations, Camp Edwards
2.36 rocket launcher	Oct '53	
M79 grenade launcher	Aug '68 - May '70	Range Safety Regulations, Camp Edwards
M79 HE and practice	May '70	Range Safety Regulations, Camp Edwards
pistols up to .45 cal.	Jul '73 - Feb '89	Range Safety Regulations, Camp Edwards
9mm ball, pistol	Feb '89	Range Safety Regulations, Camp Edwards
pistol, all calibers	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
shotgun	Feb '90 - Mar '94	Range and Training Facilities, Camp Edwards
5.56mm rifle, ball and tracer	Sep '91 - Mar '94	Range and Training Facilities, Camp Edwards

## Summary of Known Activities at Range S-EAST

Current Designation: S-EAST

Former Designation - Date of Change:

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 73982064

Basic Function: Transition Range

Maps/sketches/photos:

Map Reference Number: 20

Historic Activities	Dates	Source
AR/MG transition	Feb '89	Range Safety Regulations, Camp Edwards
5.56mm and 7.62mm ball	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm and 7.62mm tracer	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm rifle, 7.62mm MG	Sep '91 - Mar '94	Range and Training Facilities, Camp Edwards

## Summary of Known Activities at Range S-WEST

Current Designation: S-WEST

Former Designation - Date of Change:

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 73902070

Basic Function: Transition Range

Maps/sketches/photos:

Map Reference Number: 21

Historic Activities	Dates	Source
AR/MG transition	Feb '89	Range Safety Regulations, Camp Edwards
5.56mm and 7.62mm ball	Feb '89 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm and 7.62mm tracer	Feb '90 - Mar '94	Range Safety Regulations, Camp Edwards
5.56mm rifle, 7.62mm MG	Sep '91 - Mar '94	Range and Training Facilities, Camp Edwards



## Summary of Known Activities at Range T

Current Designation: T

Former Designation - Date of Change: P - Feb. 1989

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 73702085

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 22

Historic Activities	Dates	Source
blanks	eb '67 - Jul '73, Feb '8	Range Safety Regulations, Camp Edwards
none	Feb '81 - Nov '83	Range Safety Regulations, Camp Edwards
rifle - not to exceed 7.62mm	Jul '73	Range Safety Regulations, Camp Edwards
MG - not to exceed 7.62mm	Jul '73	Range Safety Regulations, Camp Edwards
.50 cal., plastic ammo	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards
AT4, 9mm trainer cartridge	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range U

Current Designation: U

Former Designation - Date of Change: S - Feb. 1989

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 72462149

Basic Function: Rocket Launcher

Maps/sketches/photos:

Map Reference Number: 23

Historic Activities	Dates	Source
3.5 in. rocket launcher	Feb '67 - Feb '90	Range Safety Regulations, Camp Edwards
M-79 grenade launcher	Aug '68 - Feb '69	Range Safety Regulations, Camp Edwards
LAW practice	Feb '81 - Feb '90	Range Safety Regulations, Camp Edwards
M190 subcaliber launcher, with M73 practice rocket, 35mm	Sep '91 - Mar '94	Range Safety Regulations, Camp Edwards

### Summary of Known Activities at Range J-3

Current Designation: J-3

Former Designation - Date of Change:

Location (Narrative): Greenway Rd.

Location (Coordinates): CS 73581686

Basic Function: Test Range

Maps/sketches/photos:

Map Reference Number: 24

Historic Activities	Dates	Source
Leased to Textron Systems	Jun '78 - present	Letter from Jim Tanin to Lt. Col. R. Murphy 6/23/97 (Appendix I)
Explosive "Skeet"		
Ave. 1.3 skeets/week; max 4/week	1996	
Non-explosive tests:		
Tower Tests		
67 total	1996	
Ground Launch Tests		
58 total	1996	
Rocket Motor Ground Launch Test		
0 total	1996	
2 total	1995	
metal debris burial here or J-1 or J-2		Interview - Manfreidy



## Summary of Known Activities at Range J-1

Current Designation: J-1-inactive

Former Designation - Date of Change: Estimation and 1000 in. Anti-Tank Ranges - 1941

Location (Narrative): Greenway Rd.

Location (Coordinates): CS 74001695

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 25

Historic Activities	Dates	Source
1000 in. anti-tank	1941	Architect-Engineer's Report, June 4, 1941
rifle M-1, cal. .30	Oct '53	Range Safety Regulations, Camp Edwards
testing	Nov '83	Range Safety Regulations, Camp Edwards
Access by Textron - activities unclear		Tanin - Telecom
shaped charge assembly at bunkers		Interview - Zanis
and disposal in pits here or J-2 (see Range N)		
use of carbon disulfide as cleaning		Interview - Zanis
solvent here or J-2 (see Range N)		
metal debris burial here or J-2 or J-3		Interview - Manfreidy

## Summary of Known Activities at Range M

Current Designation: M-inactive

Former Designation - Date of Change:

Location (Narrative): Greenway Rd.

Location (Coordinates): CS 73081590

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 26

Historic Activities	Dates	Source
submachine gun	Oct '53	Range Safety Regulations, Camp Edwards
38 cal. and 45 cal. pistol	Jan '65 - Feb '89	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range Q

Current Designation: Q-inactive

Former Designation - Date of Change:

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 73482104

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 27

Historic Activities	Dates	Source
30 cal. and 7.62mm, AR-MG Transitio	Feb '67 - May '70	Range Safety Regulations, Camp Edwards
50 cal. and lighter MG	Jul '73	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm ball, rifle and MG	Feb '81	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range R

Current Designation: R-inactive

Former Designation - Date of Change: L - Feb. 1989

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 743206

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 28

Historic Activities	Dates	Source
30 cal. and 7.62mm	Feb '67 - May '70	Range Safety Regulations, Camp Edwards
blanks	Jul '73, Feb '89	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm	Feb '81 - Nov '83	Range Safety Regulations, Camp Edwards

### Summary of Known Activities at Moving Target Rifle Range

Current Designation: MT-inactive

Former Designation - Date of Change:

Location (Narrative): Greenway Rd., north of Wood Rd.

Location (Coordinates):

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 29

Historic Activities	Dates	Source
moving target rifle range	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
rifle range	1949	1949 map

## Summary of Known Activities at Musketry Range No. 2

Current Designation: Mus-2-inactive

Former Designation - Date of Change:

Location (Narrative): Greenway Rd., north of Jefferson Rd.

Location (Coordinates):

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 30

Historic Activities	Dates	Source
musketry	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941



### Summary of Known Activities at Mock Village

Current Designation: MV-inactive

Former Designation - Date of Change:

Location (Narrative): Jefferson Rd., south of Ox Pond

Location (Coordinates):

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 31

Historic Activities	Dates	Source
firing range	1949	1949 maps

## Summary of Known Activities at Range Old-A

Current Designation: Old-A

Former Designation - Date of Change: Gravity Anti-Tank Range - Oct '53

Location (Narrative): Woods Rd.

Location (Coordinates): CS 69342076

Basic Function: Anti Tank Gravity Range

Maps/sketches/photos:

Map Reference Number: 32

Historic Activities	Dates	Source
Gravity Anti-Tank Range	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
.50 cal. for 106mm RR	Nov '59 - Jan '65	Range Safety Regulations, Camp Edwards
3.5 in. rocket launcher	Nov '59 - Jan '65	Range Safety Regulations, Camp Edwards
50 cal. MG	Feb '67 - Nov '83	Range Safety Regulations, Camp Edwards
50 cal. tracer, MG	Feb '69	Range Safety Regulations, Camp Edwards
.50 cal. M2 MG	Oct '53	Range Safety Regulations, Camp Edwards
40mm AAA gun	Oct '53	Range Safety Regulations, Camp Edwards
quad 50 cal. MG M-55	Oct '53	Range Safety Regulations, Camp Edwards
37mm projectiles	late 1950s	Interview - Zanis
bazookas and MG (ball and tracer)	late 1950s	Interview - Zanis

## Summary of Known Activities at Range Old-B

Current Designation: Old-B

Former Designation - Date of Change: 1000 in. MG "A" Range and Pistol Range - Oct '53

Location (Narrative): Frank Perkins Rd.

Location (Coordinates): CS 68841968

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 33

Historic Activities	Dates	Source
1000 in. MG	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
revolver	Oct '53 - Nov '59	Range Safety Regulations, Camp Edwards
pistol	1941, Oct '53 - Jan '65	Range Safety Regulations, Camp Edwards
30 cal. and 7.62mm rifle	Feb '67 - Feb '81	Range Safety Regulations, Camp Edwards
50 cal. MG		Interview - Zanis



## Summary of Known Activities at Range Old-C

Current Designation: Old-C

Former Designation - Date of Change: MG "B" Range - Oct '53

Location (Narrative): Frank Perkins Rd.

Location (Coordinates): CS 69301914

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 34

Historic Activities	Dates	Source
MG	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
MG 1000"	Oct '53 - Nov '59	Range Safety Regulations, Camp Edwards
carbine and rifle, 1000"	Jan '65	Range Safety Regulations, Camp Edwards
30 cal. and 7.62mm rifle	Feb '67 - Jul '73	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm rifle	Feb '81	Range Safety Regulations, Camp Edwards
50 cal. MG		Interview - Zanis

## Summary of Known Activities at Range Old-D

Current Designation: Old-D

Former Designation - Date of Change: Anti-Aircraft Miniature Range - Oct '53

Location (Narrative): Frank Perkins Rd.

Location (Coordinates): CS 69701862

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 35

Historic Activities	Dates	Source
.22 cal.	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
MG 1000"	Oct '53 - Nov '59	Range Safety Regulations, Camp Edwards
carbine and rifle, 1000"	Jan '65	Range Safety Regulations, Camp Edwards
30 cal. and 7.62mm rifle	Feb '67 - Jul '73	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm rifle	Feb '81	Range Safety Regulations, Camp Edwards
50 cal. MG		Interview - Zanis

## Summary of Known Activities at Ranges G-A and G-B

Current Designation: G-A/G-B-inactive

Former Designation - Date of Change:

Location (Narrative): north side of Dolan Rd.

Location (Coordinates):

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 36

Historic Activities	Dates	Source
Known Distance Rifle Range	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
carbine cal. .30	Oct '53	Range Safety Regulations, Camp Edwards
rifle M-1 cal. .30	Oct '53	Range Safety Regulations, Camp Edwards



### Summary of Known Activities at Range GN-1

Current Designation: GN-1-inactive

Former Designation - Date of Change:

**Location (Narrative):** Howe Rd., junction of Frank Perkins Rd.

**Location (Coordinates):**

**Basic Function: Grenade Range**

Maps/sketches/photos: Appendix D

Map Reference Number: 37

Historic Activities	Dates	Source
grenades (practice)	Oct '53	Range Safety Regulations, Camp Edwards

Rd.

and

## Safety Regulations, Camp Edwards

## Summary of Known Activities at Range Old-H

Current Designation: Old-H

Former Designation - Date of Change: Mortar Range - 1941

Location (Narrative): Greenway Rd., adjacent to I

Location (Coordinates):

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 39

Historic Activities	Dates	Source
mortar range	1941	Architect-Engineer's Report on Camp Edwards, June 4, 1941
4.2 in., 81mm, 60mm mortars	Oct. '53	Range Safety Regulations, Camp Edwards
squad combat firing	Nov '59	Range Safety Regulations, Camp Edwards
.30 cal. and 7.62 infantry weapons	Nov '59 - Jan '65	Range Safety Regulations, Camp Edwards



## Summary of Known Activities at Range Old-N

Current Designation: Old-N

Former Designation - Date of Change:

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 74022072

Basic Function: Practice Range

Maps/sketches/photos: Appendix D

Map Reference Number: 40

Historic Activities	Dates	Source
blanks	Feb '67 - May '70	Range Safety Regulations, Camp Edwards
5.56 and 7.62 blank	Feb '81	Range Safety Regulations, Camp Edwards
semi-automatic rifle, not to exceed	Jul '73	Range Safety Regulations, Camp Edwards
7.62mm		
closed	Dec '81	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range Old-O

Current Designation: Old-O

Former Designation - Date of Change:

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 73802082

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 41

Historic Activities	Dates	Source
30 cal. and 7.62mm	Feb '67 - Jul '73	Range Safety Regulations, Camp Edwards
5.56 and 7.62mm ball, rifle and MG	Feb '81 - Nov '83	Range Safety Regulations, Camp Edwards

## Summary of Known Activities at Range Old-R

Current Designation: Old-R

Former Designation - Date of Change:

Location (Narrative): Gibbs Rd.

Location (Coordinates): CS 73082123

Basic Function: Practice Range

Maps/sketches/photos:

Map Reference Number: 42

Historic Activities	Dates	Source
30 cal. and 7.62mm	Feb '67 - May '70	Range Safety Regulations, Camp Edwards
blanks	Jul '73	Range Safety Regulations, Camp Edwards
rifle and MG, not to exceed 7.62mm	Jul '73	Range Safety Regulations, Camp Edwards
none	Jan '79	Range Safety Regulations, Camp Edwards
81mm and 4.2 in. mortar	Feb '82 - Nov '83	Change 3 to Camp Edwards Regulation
HE	Feb '82 - Nov '83	Range Safety Regulations, Camp Edwards









# DRAFT RANGE USE HISTORY REPORT

## Appendix D. Available Sketches and Photos of Firing Ranges

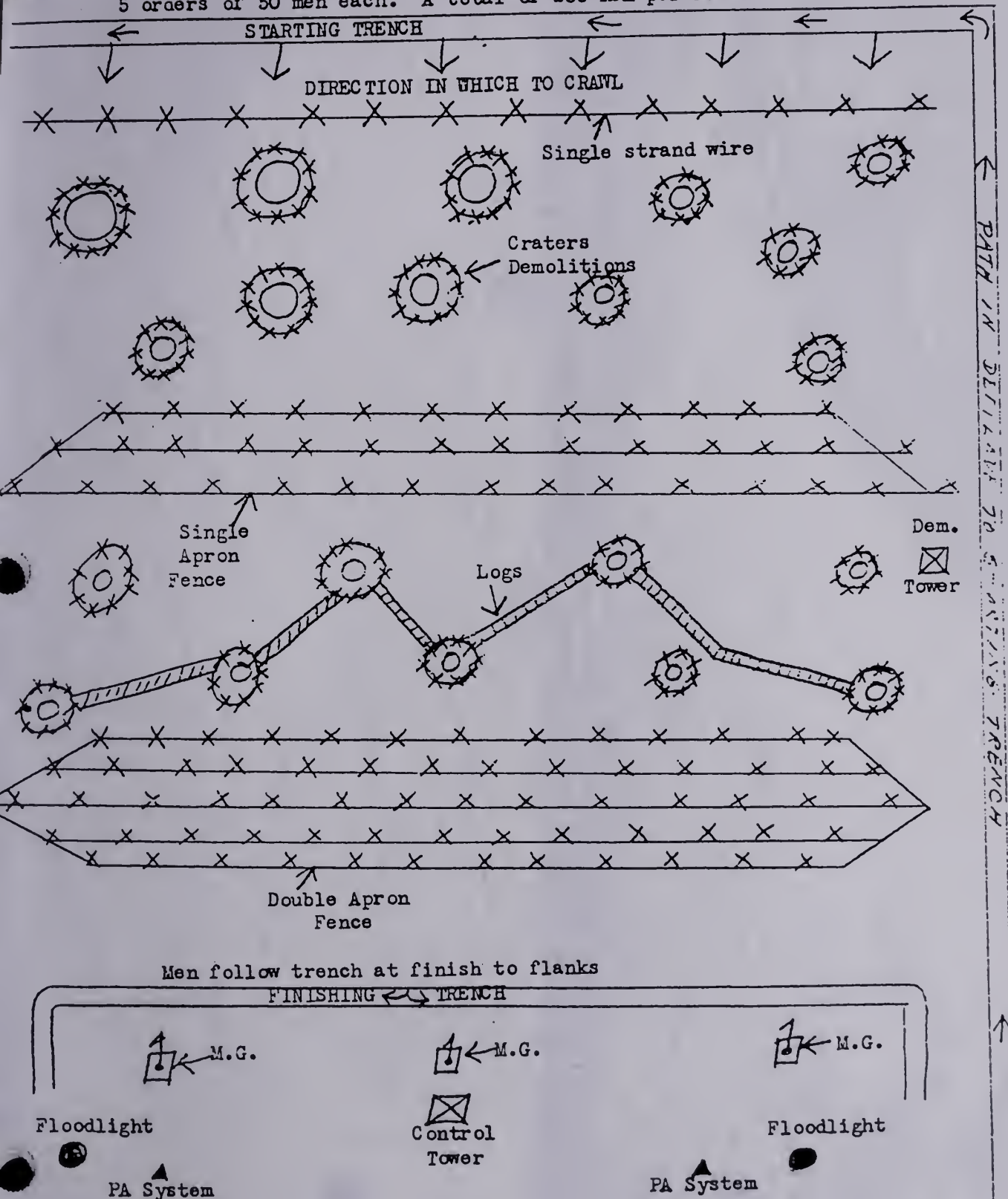




SKETCH -- LAYOUT OF THE INFILTRATION COURSE  
RANGE "I"

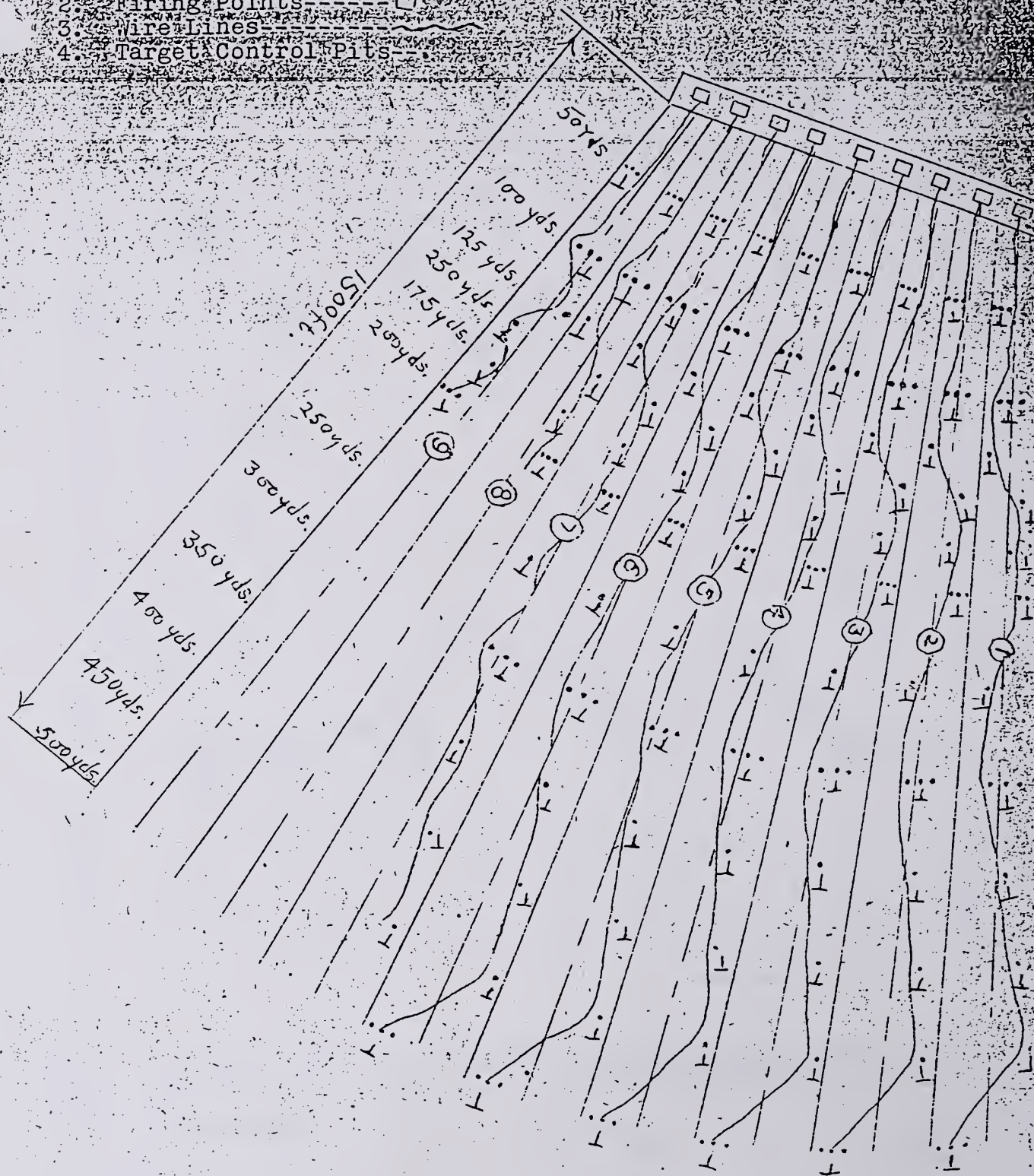
DRAFT

5 orders of 50 men each. A total of 250 men per run.



# LEGEND

1. Field Telephone
2. Firing Points
3. Wire Lines
4. Target Control Pits

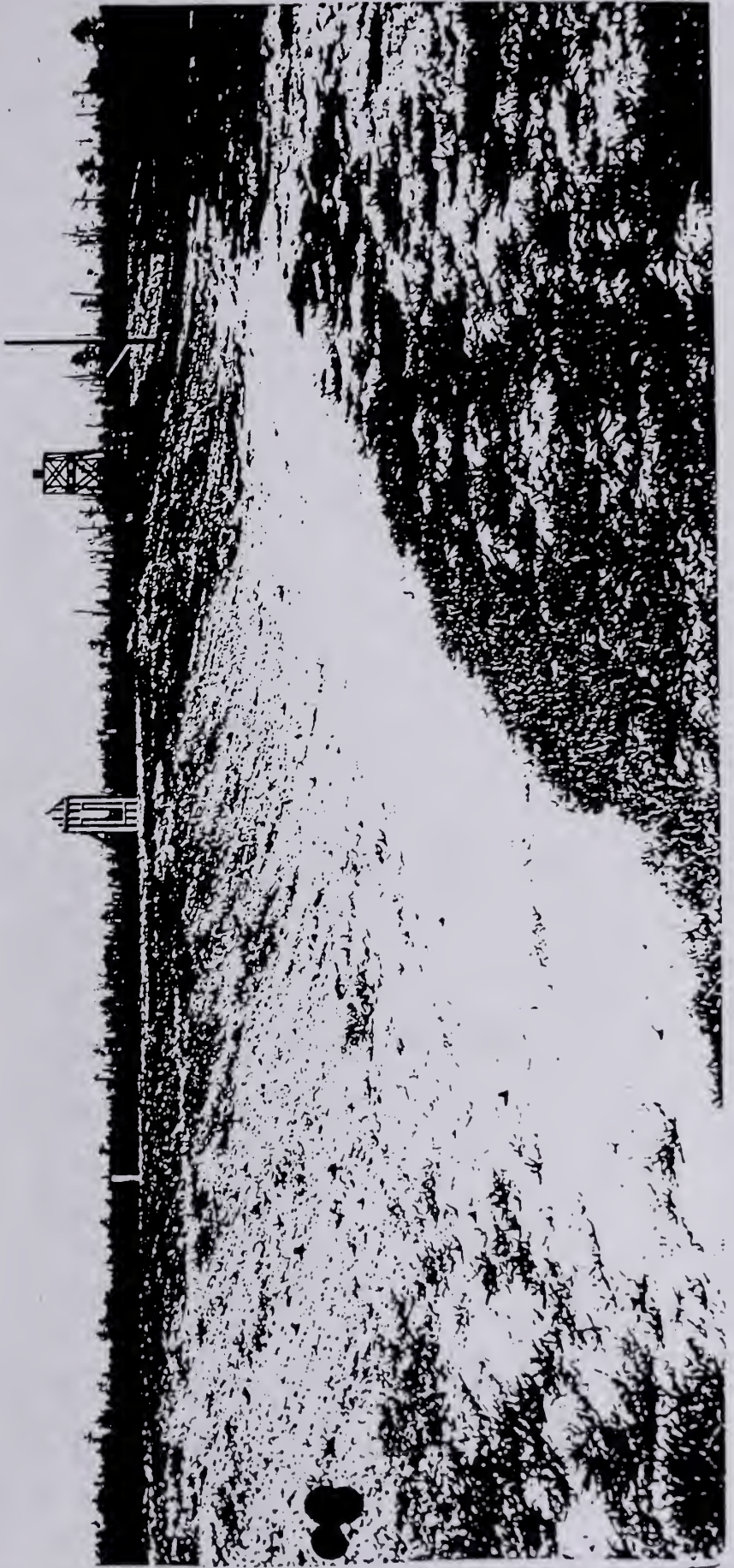




*Benjamin*  
*Franklin*

9 LARKS

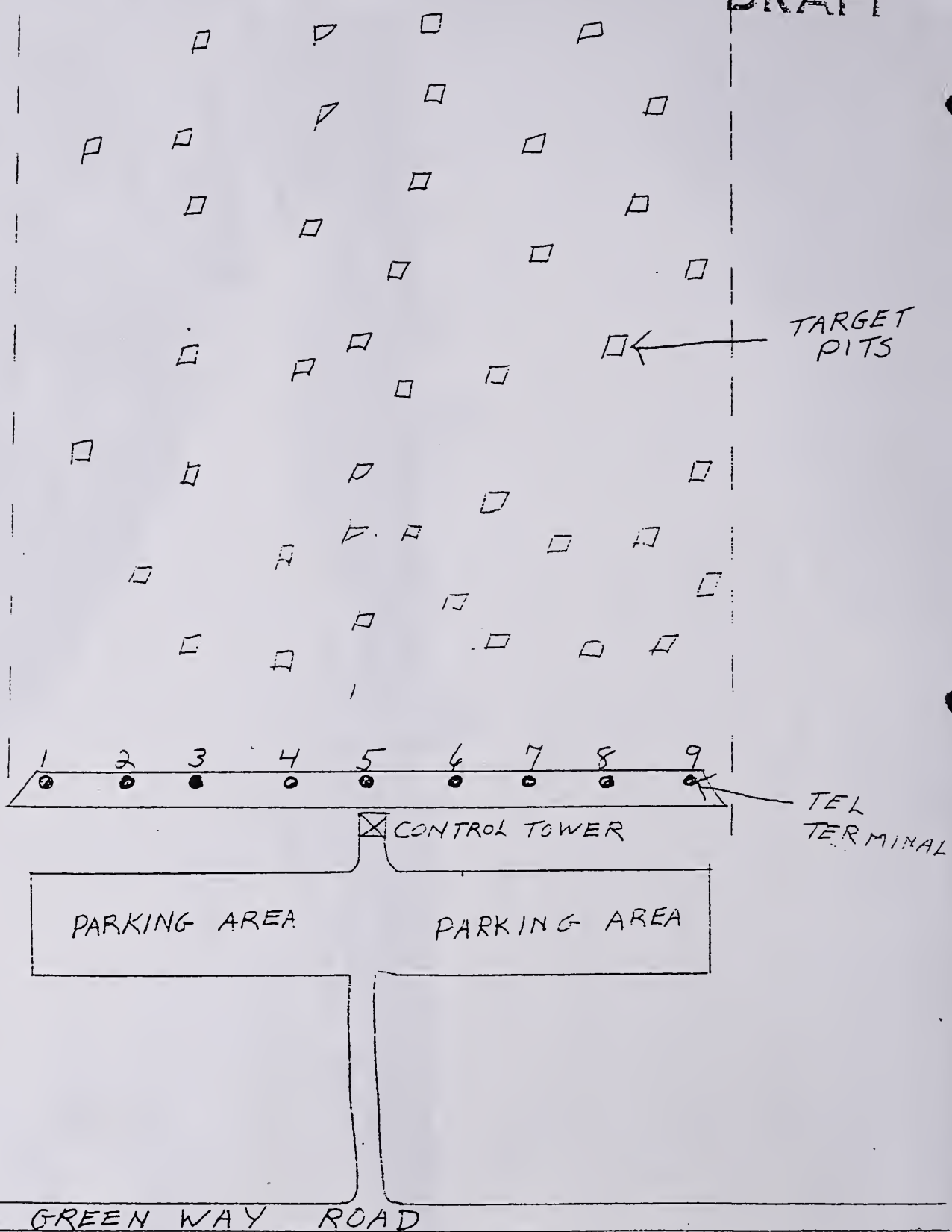
1953



Lot 4 #2

SKETCH -- RANGE J-1 and J-2

DRAFT



LAYOUT OF TRANSITION RANGE  
"J-1," "J-2"

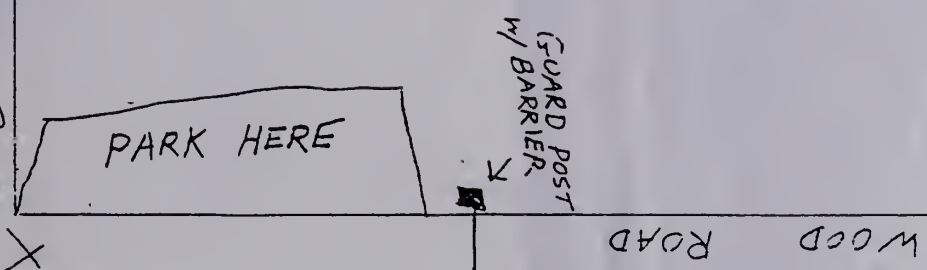
Incl #3



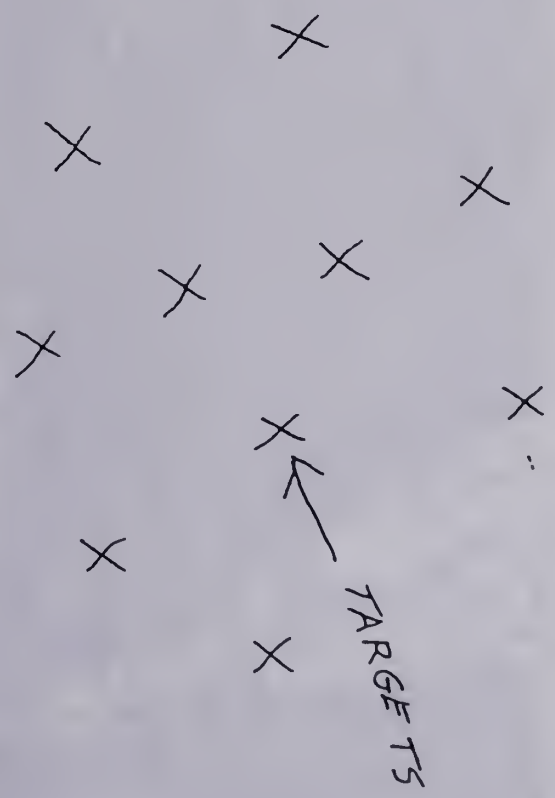
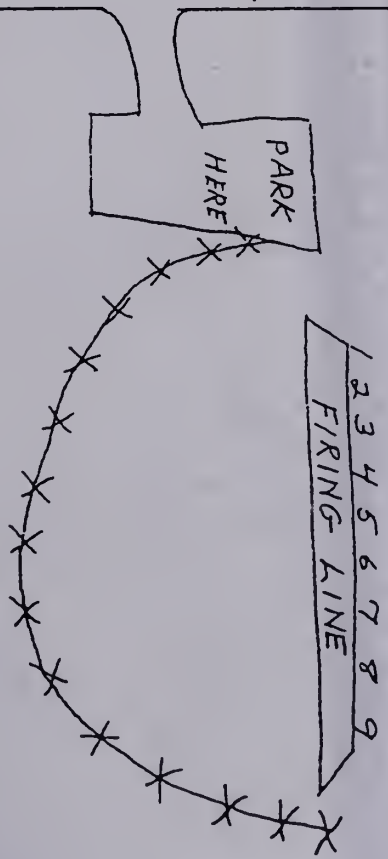
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LAYOUT OF  
3.5- 2.36 ROCKET  
RANGE "K"

GREEN WAY ROAD

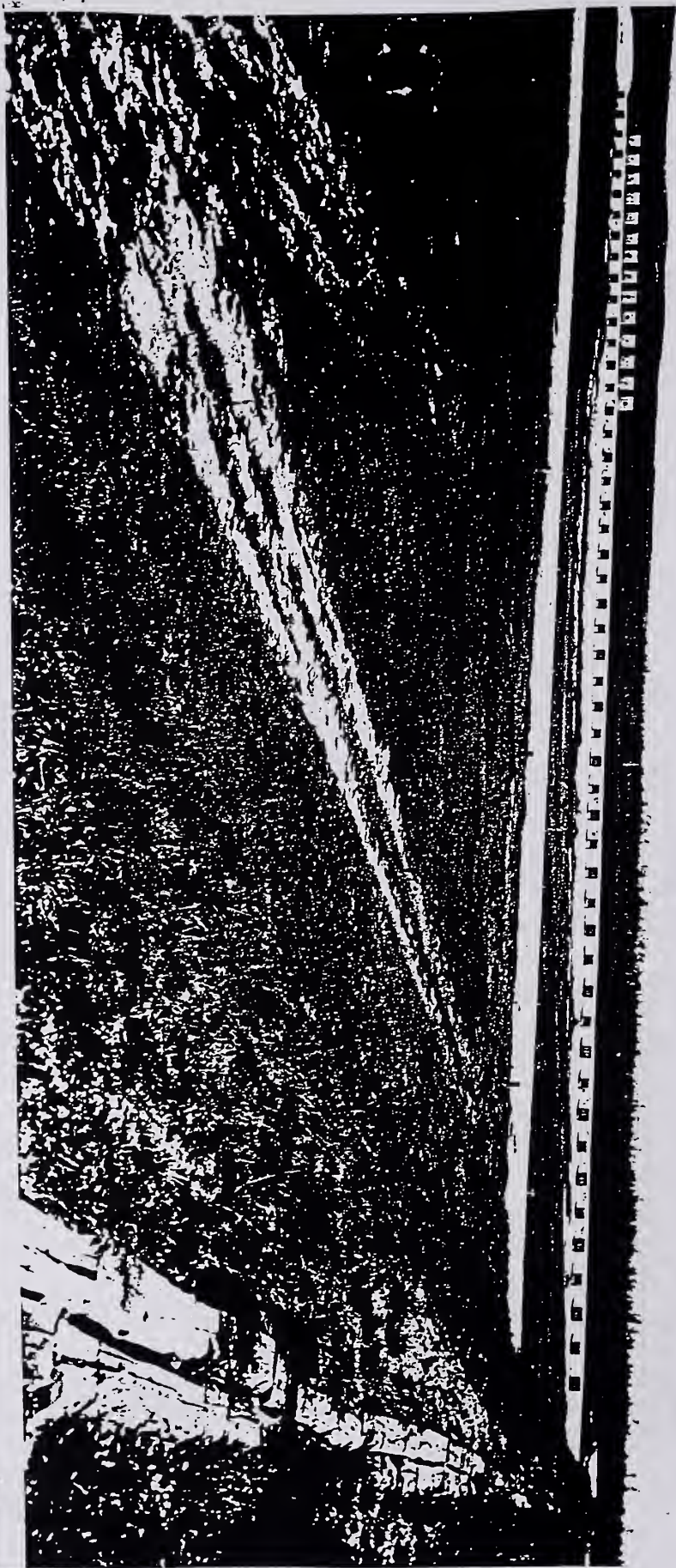


RANGE GUARD



1953

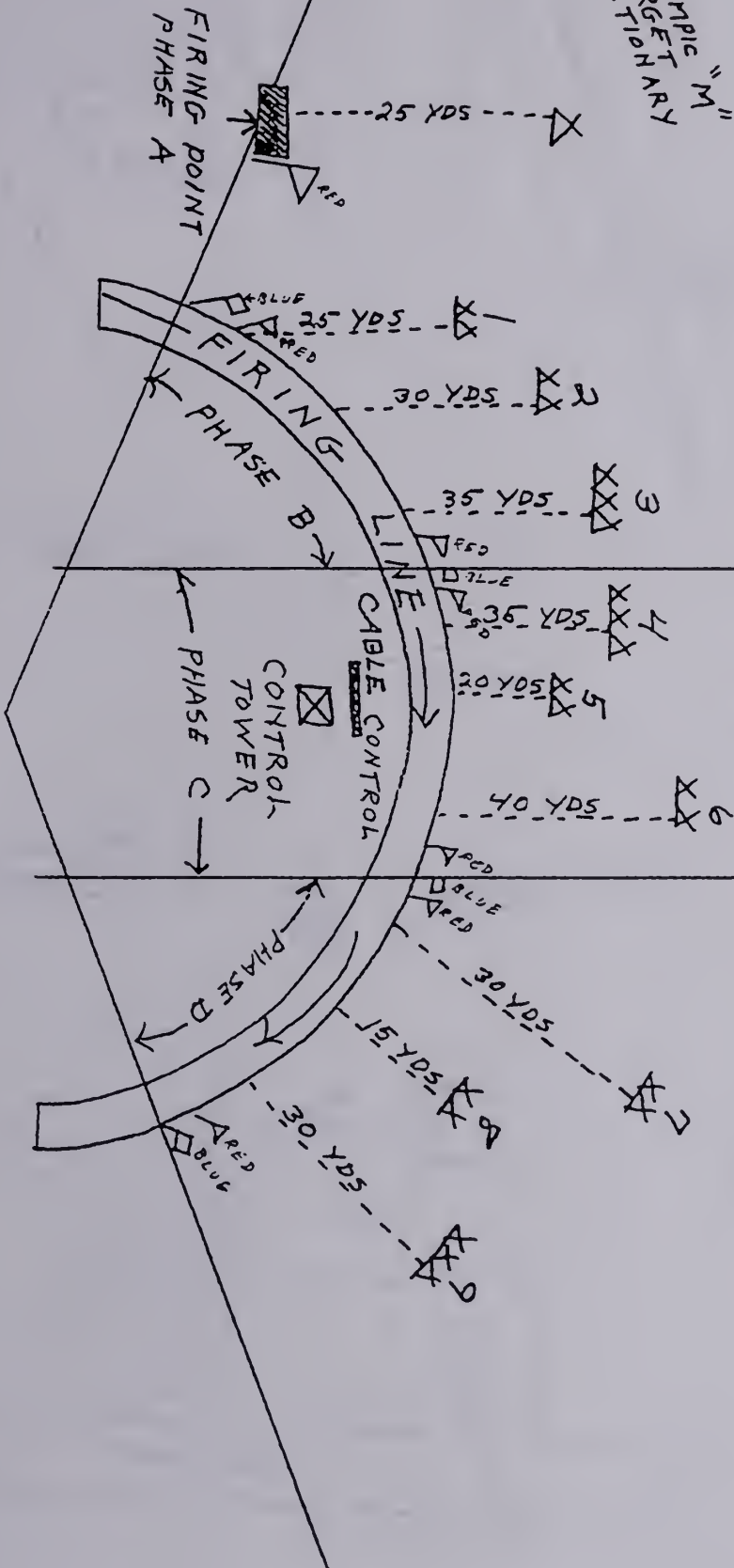
*Range 150*  
150 POINTS



24 4011

DRAFT

OLYMPIC "M"  
TARGET ARY  
STATIONARY



GREENWAY ROAD

LATRINE

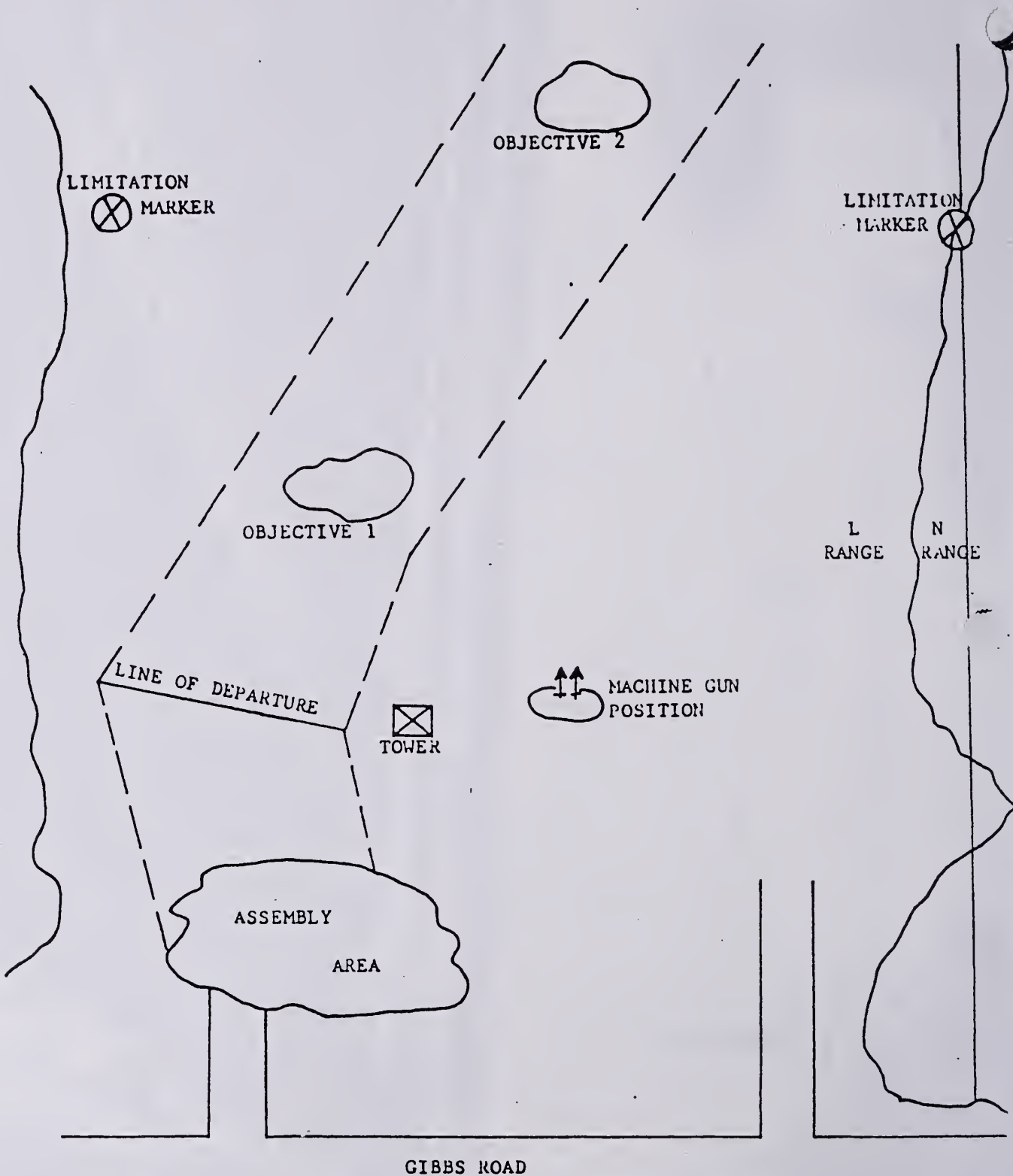
GUARD HOUSE  
w/ROAD BLOCK

LAYOUT OF M-3 SUB MACHINE GUN  
RANGE M-1, M-2, M-3



8 January 1979

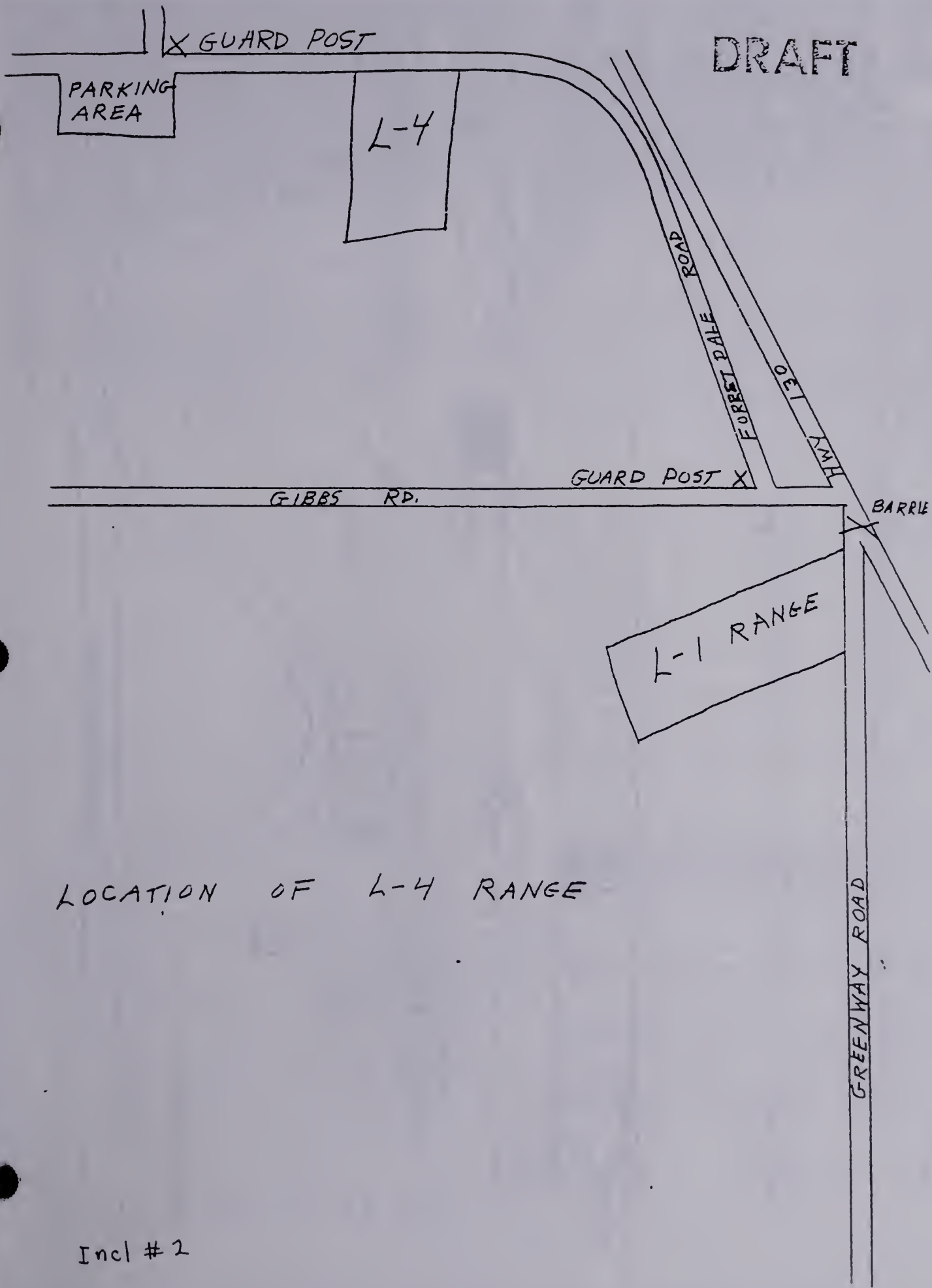
CP-EDW Reg 385-63



L RANGE -  
SQUAD ATTACK COURSE

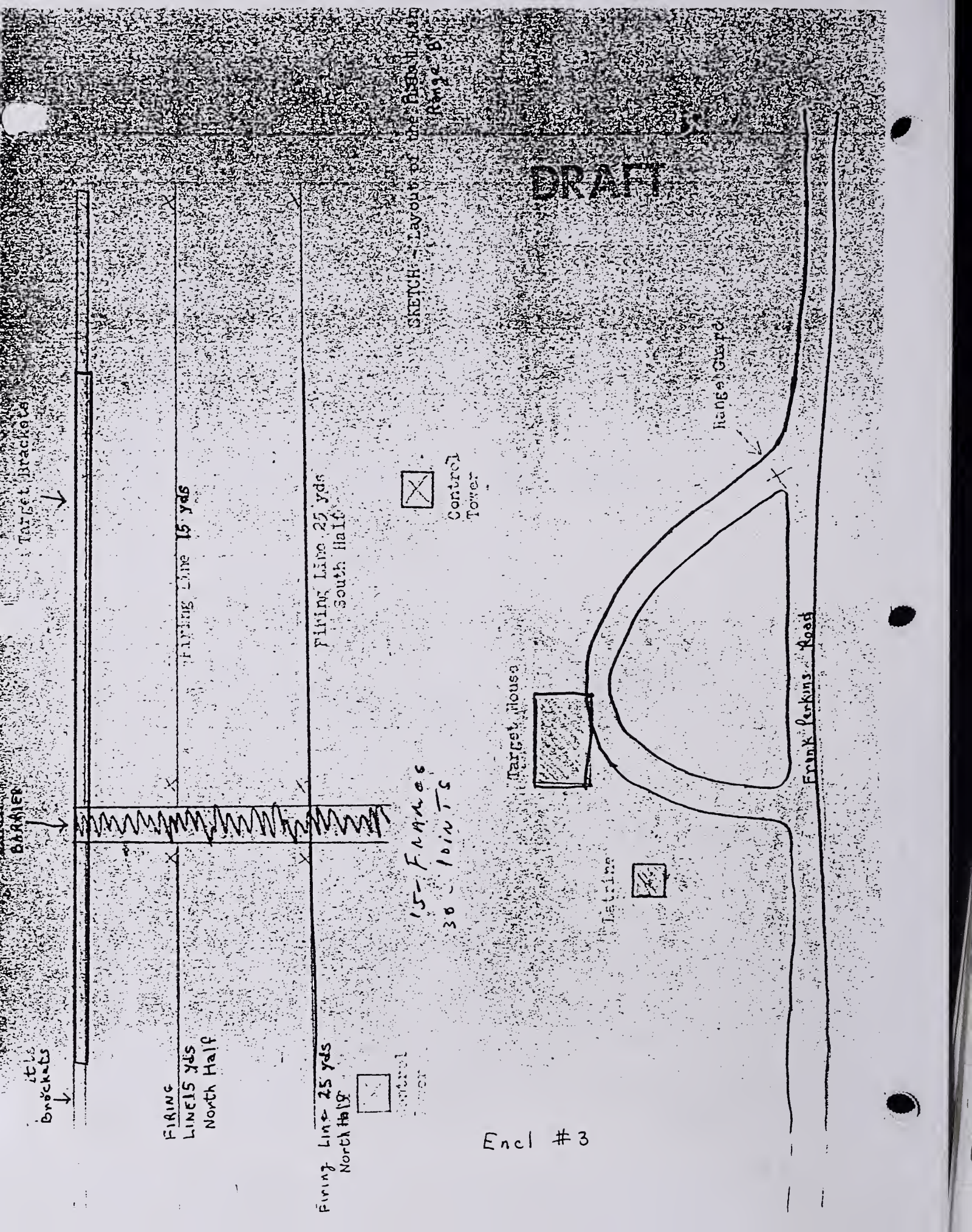


DRAFT



LOCATION OF L-4 RANGE

Incl # 2



DRAFT

Target Brackets

Barrier

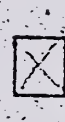
it's Brackets

Firing Line 25 yds North Half

Firing Line 15 yds

Firing Line 25 yds North Half

Firing Line 25 yds South Half



Control Tower

15- Fences  
30 - Points



Control Tower

Target House



Latrine



Range Guard

Frank Perkins Road

Encl #3



SKETCH - Layout for 1000" Machine  
Gun Range "C"

DRAFT

PARKING  
AREA

PARKING  
AREA

TARGET  
HOUSE

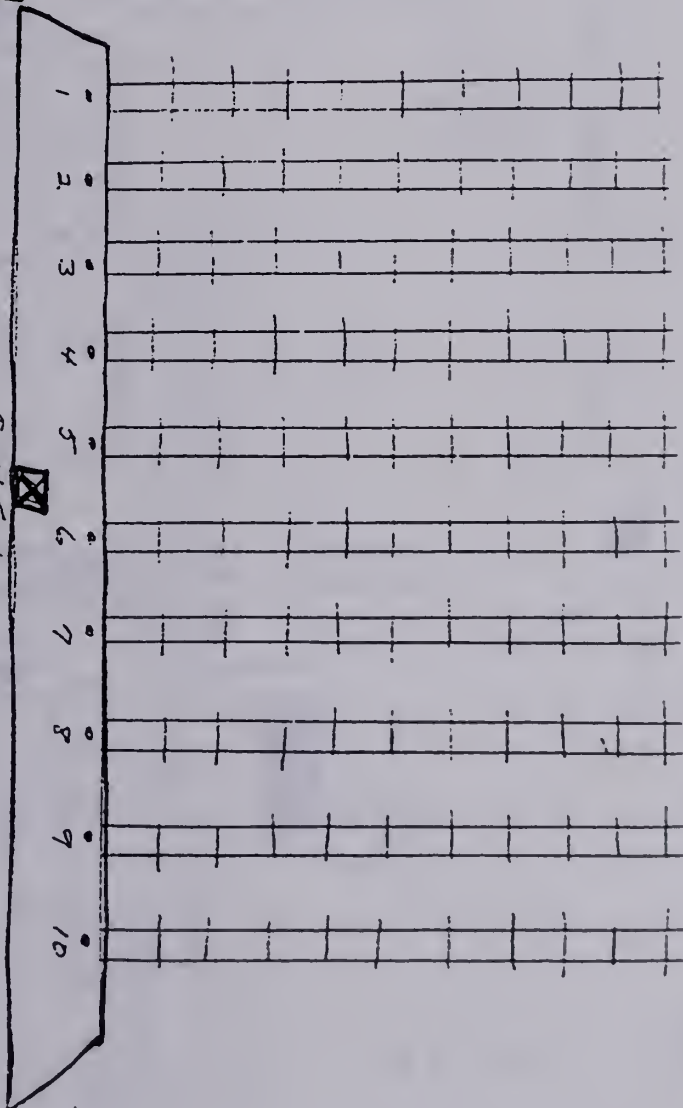
LATRINE

CONTROL  
TOWER

30 Frames  
40 Firing Points

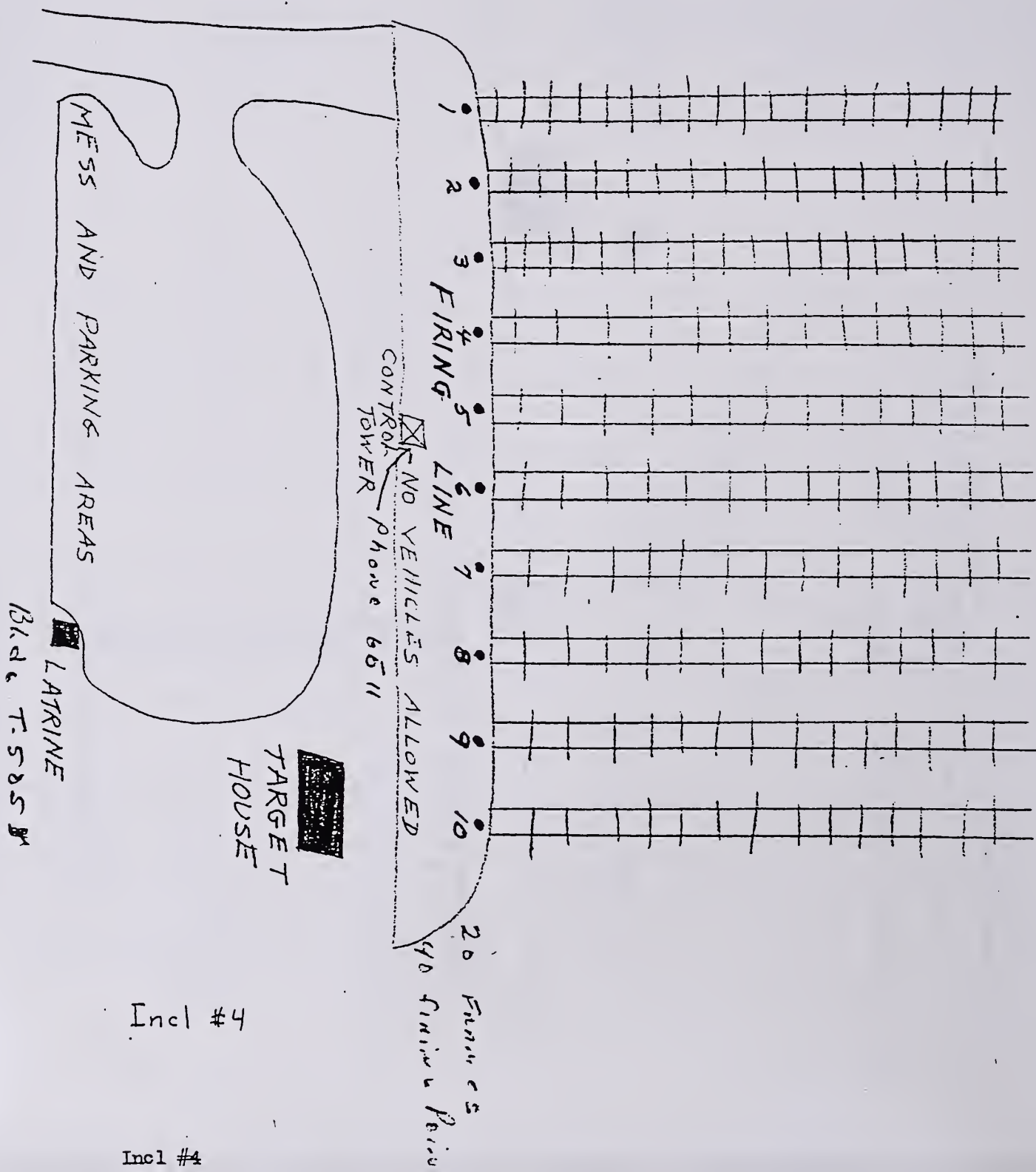
LAYOUT FOR 1000 IN. MACHINE  
GUN RANGE "C"

ENCL # 3

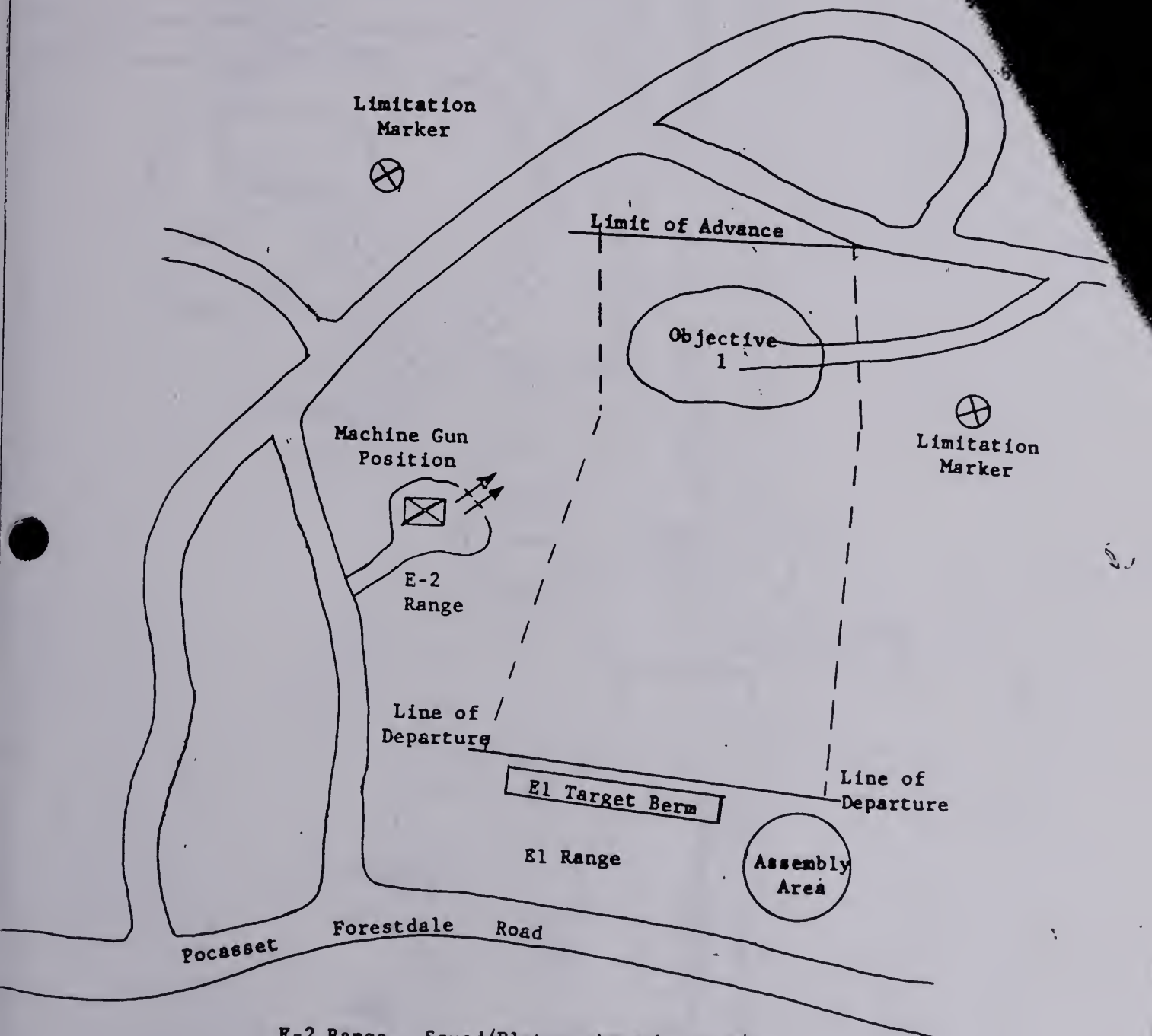


# LAYOUT FOR THE 1000 IN. MACHINE GUN RANGE "D"

DRAFT





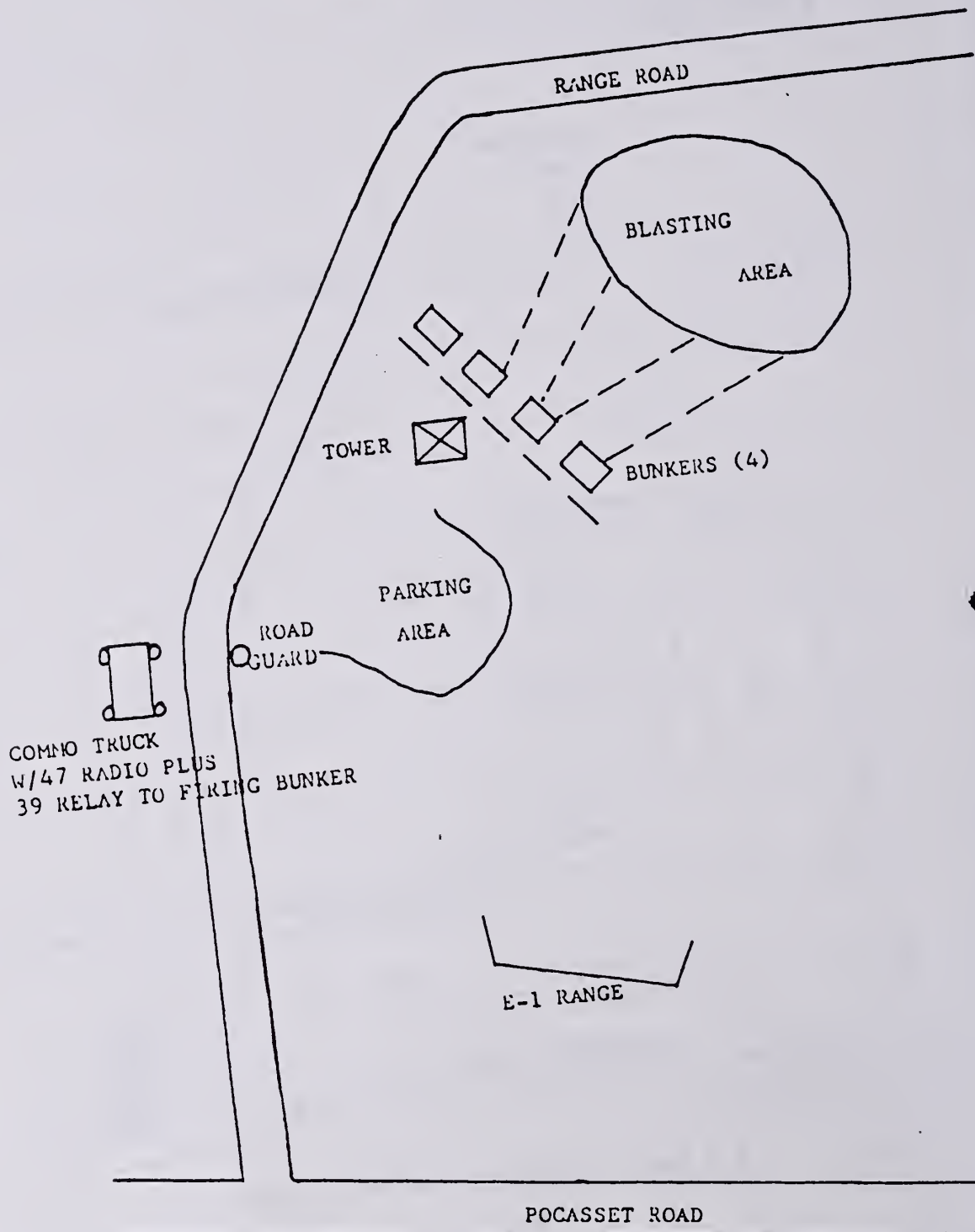


E-2 Range - Squad/Platoon Attack Course

Figure 1

8 January 1979

E-2 RANGE



# DRAFT

RANGE

5 tired  
-TIRK, ET'S  
HERE.

LAYOUT OF MACHINE GUN  
FIELD FIRING INTO IMPACT AREA  
AT SIX HOUETTE TARGETS

INTO IMPACT  
AREA

GUARD HOUSE

w/ ROAD Black

POCASSET FOREST ROAD

# LATRINE

Incl #1

Table 43

DRAFT

# LAYOUT OF CARBINE AND RIFLE RANGES "G-A" AND "G-B"

TUNNEL TO "G-B"  
PITS REACH FROM  
PITS AT RIGHT END  
OF G-A RANGE

LATRINES AND  
TARGET HOUSES  
PITS  
151  
264

TURPEN TINE ROAD

TARGETS 1 THROUGH 150  
X TARGET HOUSES  
LATRINES PITS  
150

-100 YD LINE

200 YD LINE

300 YD LINE

← CONTROL TOWERS →

BOLAN

ROAD

300 YD LINE

← CONTROL → TOWERS →

TUNNEL  
TO  
PITS

LATRINE

LATRINE

Incl #3



DRAFT

SKETCH POSTING GUARDS, COURT #1 & #2

GUARD

FRANK PERKINS ROAD

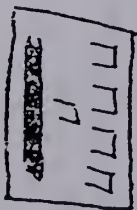
GUARD

MITTON ROAD

COURT #1

HOWE ROAD

COURT #2



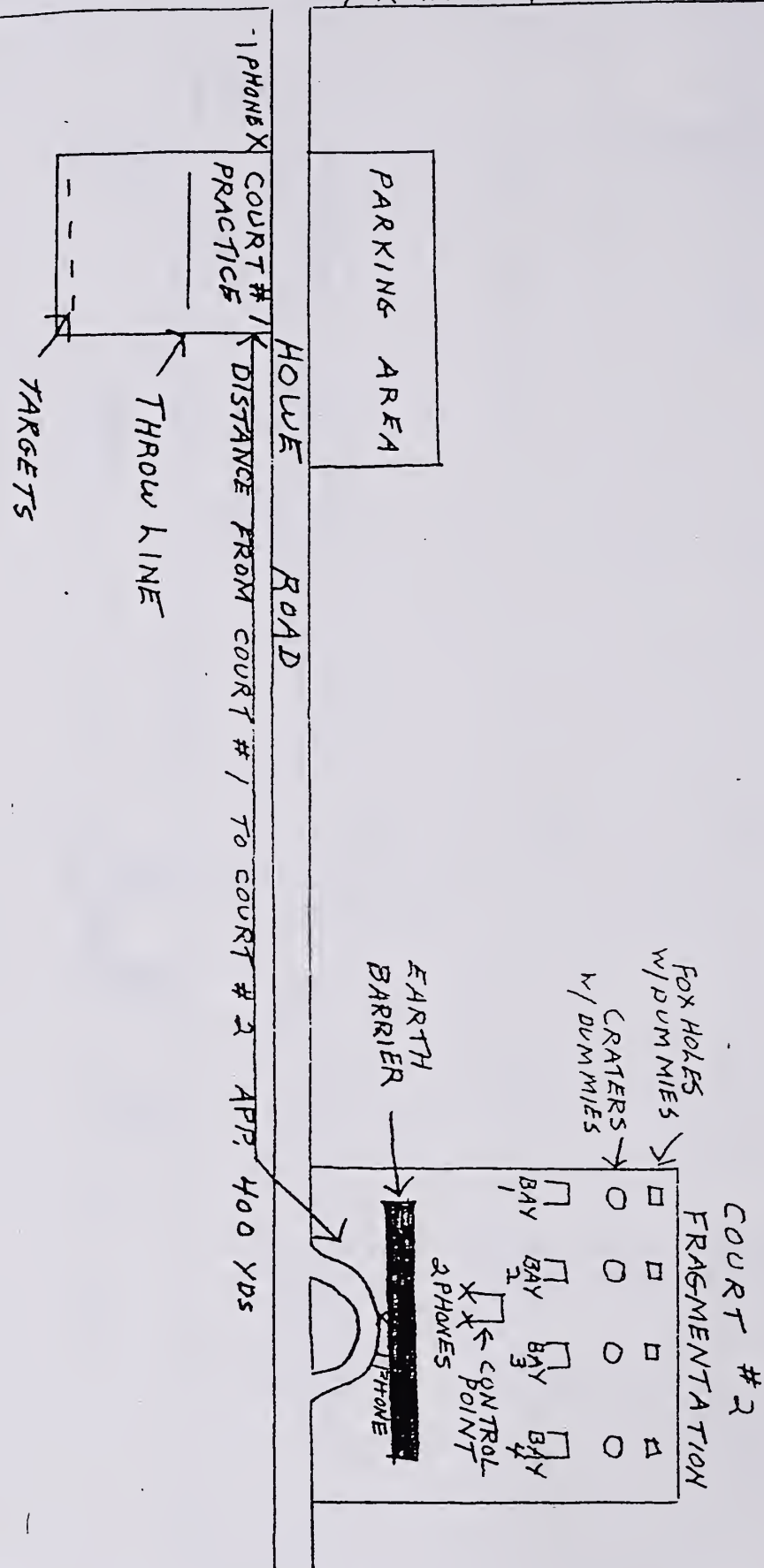
TURPENTINE ROAD

GUARD

GUARD

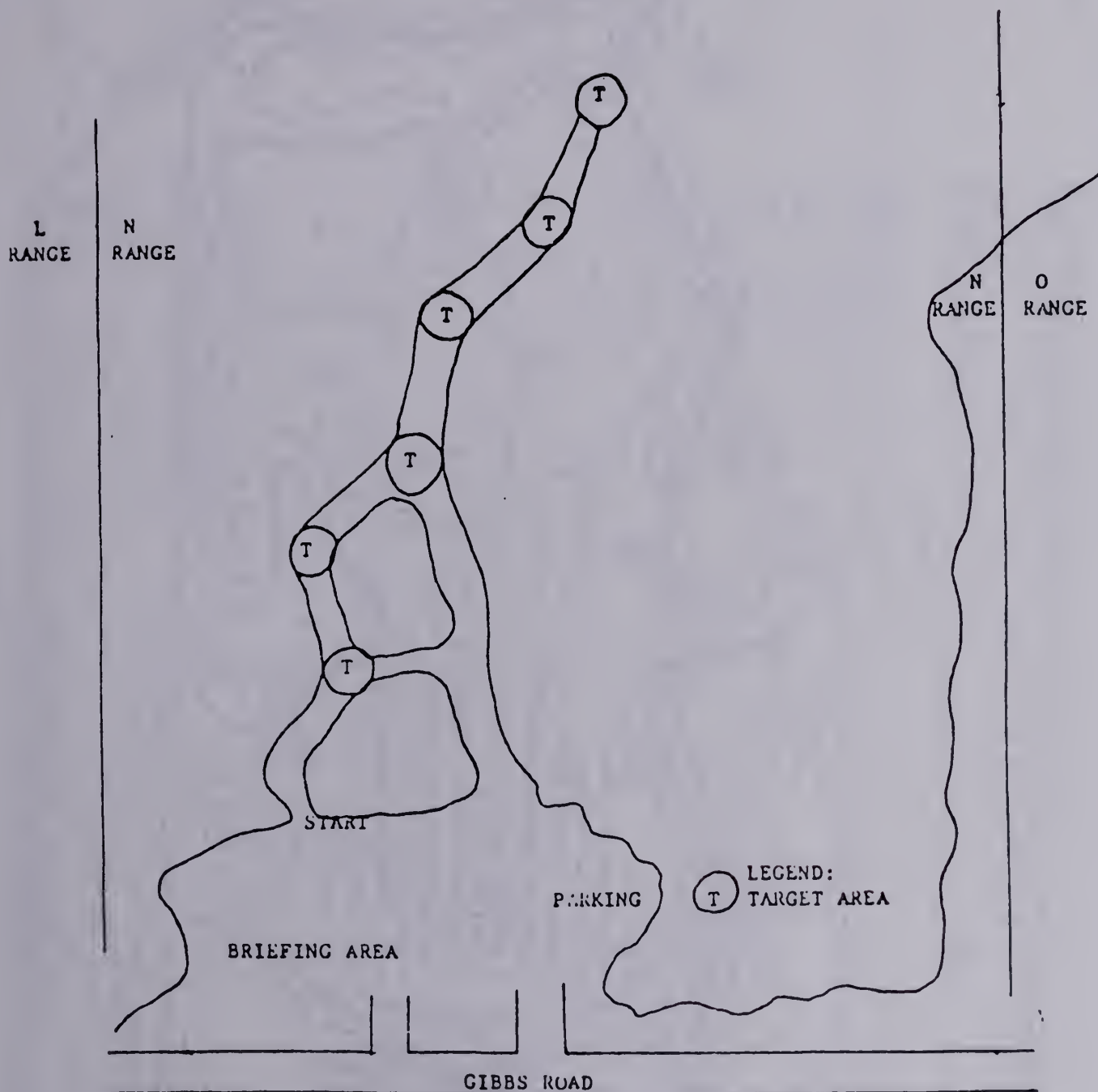
DRAFT

LAYOUT OF GRENADE COURTS  
NO. 1 AND NO. 2



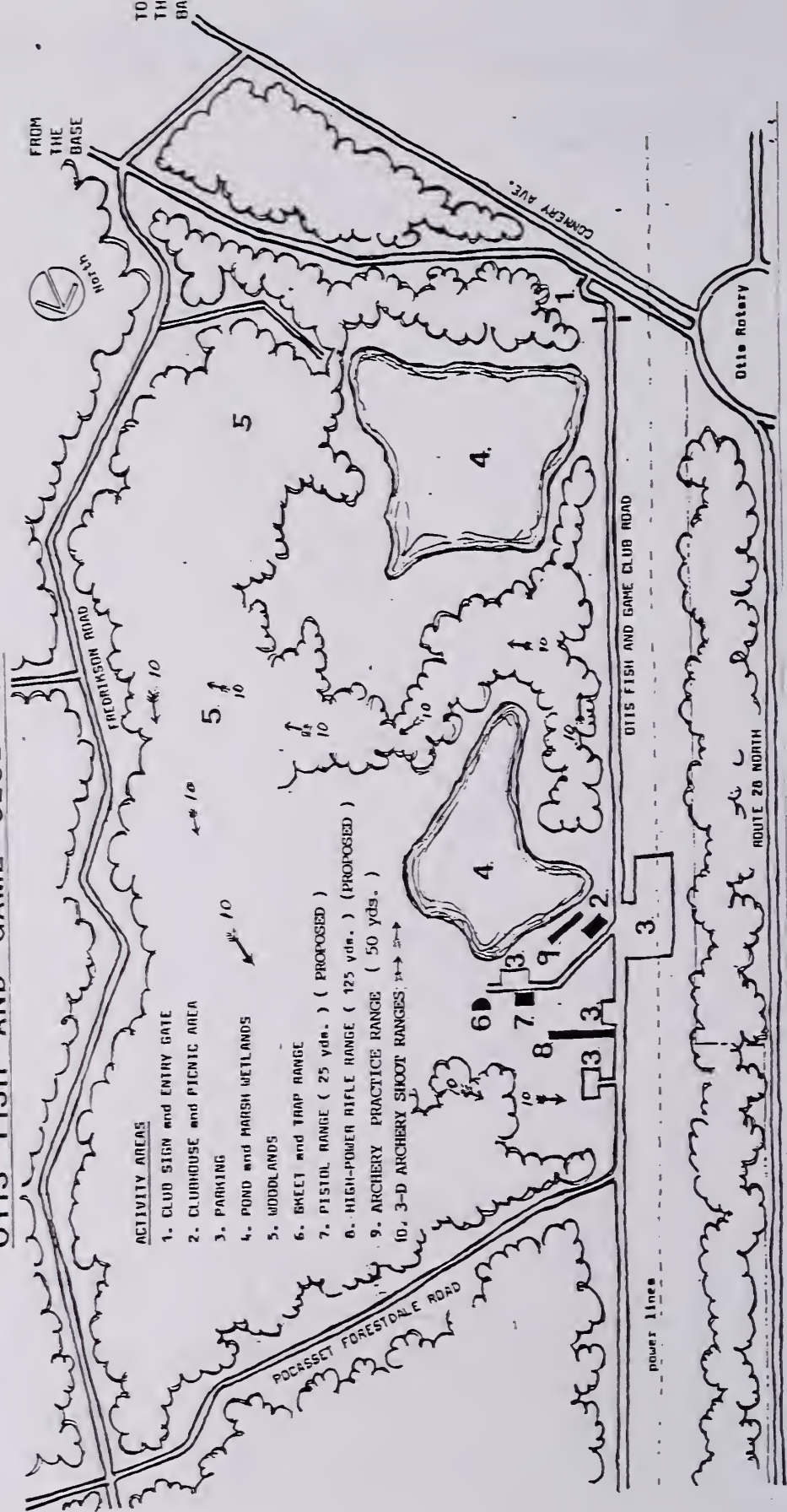
8 January 1979

CP-EDW Reg 385-63



N RANGE -  
INDIVIDUAL REACTION COURSE

# OTIS FISH AND GAME CLUB MAP











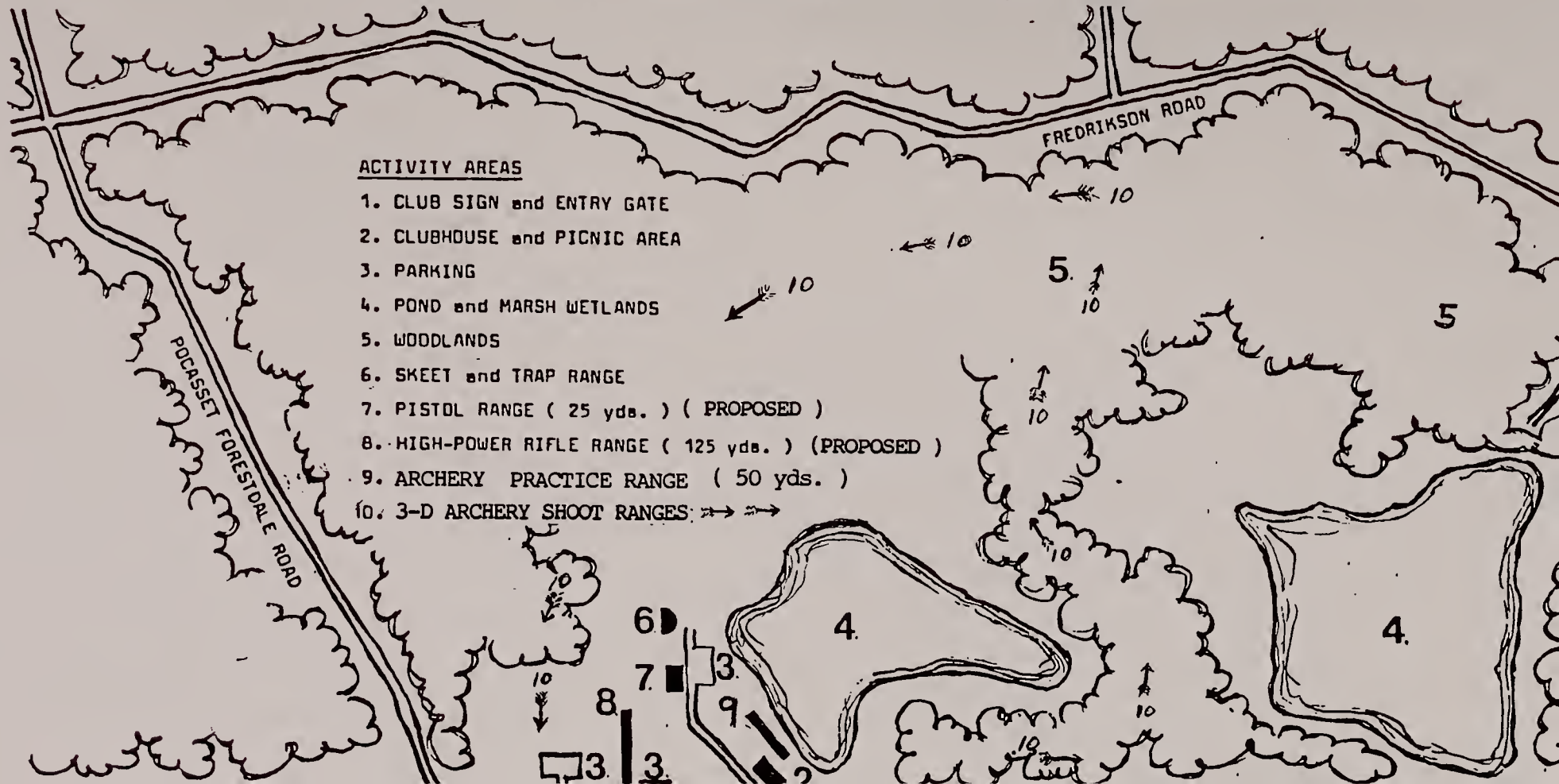




# OTIS FISH AND GAME CLUB MAP

## ACTIVITY AREAS

1. CLUB SIGN and ENTRY GATE
2. CLUBHOUSE and PICNIC AREA
3. PARKING
4. POND and MARSH WETLANDS
5. WOODLANDS
6. SKEET and TRAP RANGE
7. PISTOL RANGE ( 25 yds. ) ( PROPOSED )
8. HIGH-POWER RIFLE RANGE ( 125 yds. ) ( PROPOSED )
9. ARCHERY PRACTICE RANGE ( 50 yds. )
10. 3-D ARCHERY SHOOT RANGES











# DRAFT RANGE USE HISTORY REPORT

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## Appendix E. Summary of Mortar, Gun Positions and Targets



Table E-1  
Gun Positions

Current Designation	Map Reference Number	Location - Narrative	Location - Coordinates	Historic Activities	Dates	Source
GP-1-inactive	43	Stovell Rd	CS 699148	105/155mm HE, Fuse Q, IT and VT rounds	Jan '65 - Aug '68	Range Safety Regulations, Camp Edwards
GP-2	44	Frank Perkins Rd	CS 69901801	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	MMR Environmental Management Analysis Program, 1991
GP-3-inactive	45	Howe Rd	CS 707155	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
GP-4-inactive	46	Howe Rd	CS 705155	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
GP-5	47	Howe and Frank Perkins Rds.	CS 702615	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
GP-6	48	Minton Rd	CS 71101603	105/155mm HE, Fuse Q, IT and VT rounds	Jan '65 - Jan '79	Range Safety Regulations, Camp Edwards
				155mm How	Nov '83	Range Safety Regulations, Camp Edwards
GP-7	49	Minton Rd	CS 70851619	105/155mm HE, Fuse Q, IT and VT rounds	FY '89	MMR Environmental Management Analysis Program, 1991
				155mm How	Jan '65 - Jan '79	Range Safety Regulations, Camp Edwards
GP-8	50	Milton Rd	CS 70321620	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	MMR Environmental Management Analysis Program, 1991
				155mm How	FY '89	Range Safety Regulations, Camp Edwards
GP-9	51	Howe Rd	CS 71241542	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
				155mm How	FY '89	MMR Environmental Management Analysis Program, 1991
GP-10	52	Howe Rd	CS 71081544	105/155mm HE, Fuse Q, IT and VT rounds	Jan '65 - Jul '73	Range Safety Regulations, Camp Edwards
				155mm How	Nov '83	Range Safety Regulations, Camp Edwards
GP-11	53	Howe Rd	CS 70831546	105/155mm HE, Fuse Q, IT and VT rounds	FY '89	MMR Environmental Management Analysis Program, 1991
				155mm How	Nov '83	Range Safety Regulations, Camp Edwards
GP-12	54	Cataumet Rd	CS 70392252	105/155mm HE, Fuse Q, IT and VT rounds	Jan '65 - Jul '73	Range Safety Regulations, Camp Edwards
				155mm How	FY '89	MMR Environmental Management Analysis Program, 1991
GP-14	55	Jefferson Rd	CS 69882297	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
				155mm How	FY '89	MMR Environmental Management Analysis Program, 1991
GP-15-inactive	56	Pocasset-Forestdale Rd	CS 70211671	105/155mm HE, Fuse Q, IT and VT rounds	Jan '65 - May '70	Range Safety Regulations, Camp Edwards
GP-16	57	Jefferson Rd	CS 69682292	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
				155mm How	Jan '65 - Jan '79	Range Safety Regulations, Camp Edwards
				heavily used for 105mm guns powder bags found in woods	Nov '83	Range Safety Regulations, Camp Edwards
GP-17	58	Flatrock Rd	CS 71722346	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
				155mm How	FY '89	MMR Environmental Management Analysis Program, 1991
GP-18	59	Flatrock Rd	CS 71482343	105/155mm HE, Fuse Q, IT and VT rounds	1960's	Interview - Zanis
				155mm How	Jan '79	Range Safety Regulations, Camp Edwards
GP-19-inactive	60	Kendrick Rd	-CS 696219	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
GP-20	61	Off Cataumet Rd	CS 71222277	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
				155mm How	FY '89	MMR Environmental Management Analysis Program, 1991
GP-22	62	Monument Swamp Rd	CS 7262310	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
				155mm How	FY '89	MMR Environmental Management Analysis Program, 1991
GP-24	63	Wheelock Rd	CS 68981810	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
GP-2-old	64	South of Herbert Rd	CS 70271477	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
GP-3-old	65	South of Herbert Rd	CS 70491472	105/155mm HE, Fuse Q, IT and VT rounds	Nov '83	Range Safety Regulations, Camp Edwards
GP-4-old	66	North of Dolan Rd	CS 71571540	105/155mm HE, Fuse Q, IT and VT rounds	Jan '65 - Aug '68	Range Safety Regulations, Camp Edwards
				155mm How	Jan '65 - Aug '68	Range Safety Regulations, Camp Edwards

Table E-2  
Mortar Positions

Current Designation	Old Desig/ Date of Change	Map Reference Number	Location - Narrative	Location - Coordinates	Historic Activities	Dates	Source
MP-1	MP-4/ FY '89	67	Pocasset-Forestdale Rd.	CS 717162	4.2 in. and 81mm mortar 60mm, 81mm and 4.2 in. mortar	Jan '81 - Nov '83 FY '89	Range Safety Regulations, Camp Edwards MMR Environmental Management Analysis Program, 1991
MP-2		68	Pocasset-Forestdale Rd.	CS 71201632	4.2" and 81mm mortar	Feb '81 - Nov '83 FY '89	Range Safety Regulations, Camp Edwards MMR Environmental Management Analysis Program, 1991
MP-3		69	Pocasset-Sandwich Rd.	CS 70381726	60, 81 and 107mm mortars 4.2" and 81mm mortars	Feb '81 - Nov '83 FY '89	Range Safety Regulations, Camp Edwards MMR Environmental Management Analysis Program, 1991
MP-4	MP-1/ FY '89	70	Pocasset-Sandwich Rd.	CS 704176	60, 81 and 107mm mortar 4.2" and 81mm mortars	Jan '65 - Aug '68 Feb '81 - Nov '83	Range Safety Regulations, Camp Edwards Range Safety Regulations, Camp Edwards Range Safety Regulations, Camp Edwards
MP-5		71	Pocasset-Sandwich Rd.	CS 705180	60, 81 and 107mm mortar	FY '89	MMR Environmental Management Analysis Program, 1991
MP-6		72	Pocasset-Sandwich Rd.	CS 70471800	4.2 in. and 81mm HE mortars 60 and 81mm mortar	Nov '83 FY '89	Range Safety Regulations, Camp Edwards MMR Environmental Management Analysis Program, 1991
MP-7		73	Pocasset-Sandwich Rd.	CS 705182	60 and 81mm mortar	FY '89	Range Safety Regulations, Camp Edwards MMR Environmental Management Analysis Program, 1991
MP-8		74	Off Pocasset-Sandwich Rd.	CS 704183	60 and 81mm mortar	FY '89	MMR Environmental Management Analysis Program, 1991
MP-9	MP-5	75	Off Gibbs Rd.	CS 750201	4.2 in. and 81mm mortar	Jan '79 - Nov '83 Nov '83	Range Safety Regulations, Camp Edwards Range Safety Regulations, Camp Edwards
MP/OP 1		76	Off Pocasset-Sandwich Rd.	CS 70381812	60mm, 81mm, 4.2" HE mortar	Jan '65 - Aug '68	Range Safety Regulations, Camp Edwards Range Safety Regulations, Camp Edwards
MP-2-old		77	Off Monument Beach Rd.	CS 68861967	75mm rounds	Interview - Zanis	Interview - Zanis
MP-3-old		78	Wood Rd.	CS 69142092	75mm rounds	Feb '67 - Aug '68	Range Safety Regulations, Camp Edwards Interview - Zanis



**Table E-3**  
**Targets**

<b>Known Targets</b>	<b>Coordinates*</b>	<b>Aerial Photograph Reference</b>
Boiler	CS 72001949	
Yellow Panels	CS 71981941	CA-3, BA-1, EX-2
Boiler Brown	CS 71771919	
Junk/Bunker	CS 71481889	BK-1, TR-1/DG-1
Yellow Gas Tank	CS 71921917	CA-4
Gray Junk	CS 72011920	GS-7, TR-2/3/4
Gray Junk	CS 72181923	TR-2/3/4
White Refrig	CS 71661880	BA-3
White Stove	CS 71681855	
2 White Barrels	CS 71611847	
White Barrels	CS 72061850	PIT-1/2
Boiler	CS 72131844	CA-7, PIT-1/2
Buoy	CS 71951852	BA-2
Buoy	CS 71981851	BA-2
Buoy	CS 71941913	
Buoy	CS 71931936	
Buoy	CS 72041954	
Buoy	CS 71711938	
Buoy	CS 72081920	TR-2/3/4

\* Coordinates from 1970 and 1973 Camp Edwards SOPs.









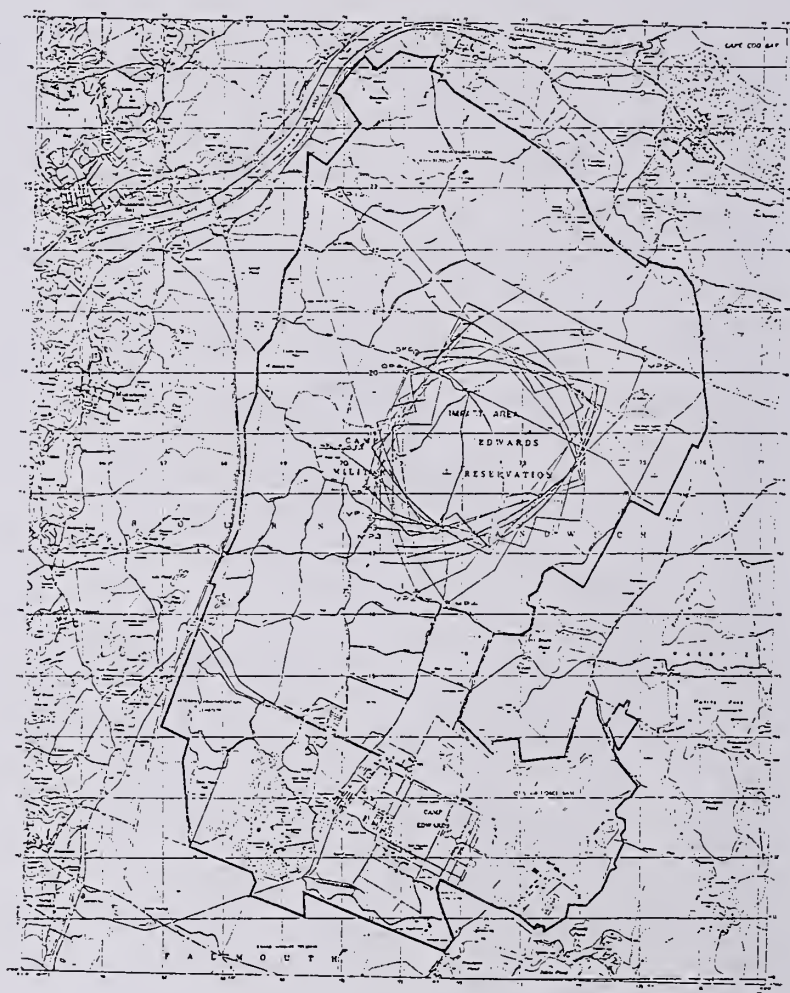
# DRAFT RANGE USE HISTORY REPORT

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## Appendix F. Available Range Fans for Mortar/Gun Positions







# LEGEND

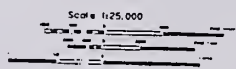
## POSITION

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## TYPE WEAPON

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- 99. 4.2"
- 100. 4.2"

NOTE:  
For clarity only one firing fan  
for mortar position 8, 7, 6 & 5  
has been shown.  
This map is not to be used  
for firing or safety  
purposes. Range time and  
illustrative only.



Data Source:  
Massachusetts Army National Guard, February 1965.  
Headquarters Camp Edwards, Bourne, Massachusetts.  
Sheet No. 1

THE COMMONWEALTH OF MASSACHUSETTS  
MASSACHUSETTS MILITARY DIVISION  
FACILITIES ENGINEERING

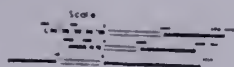
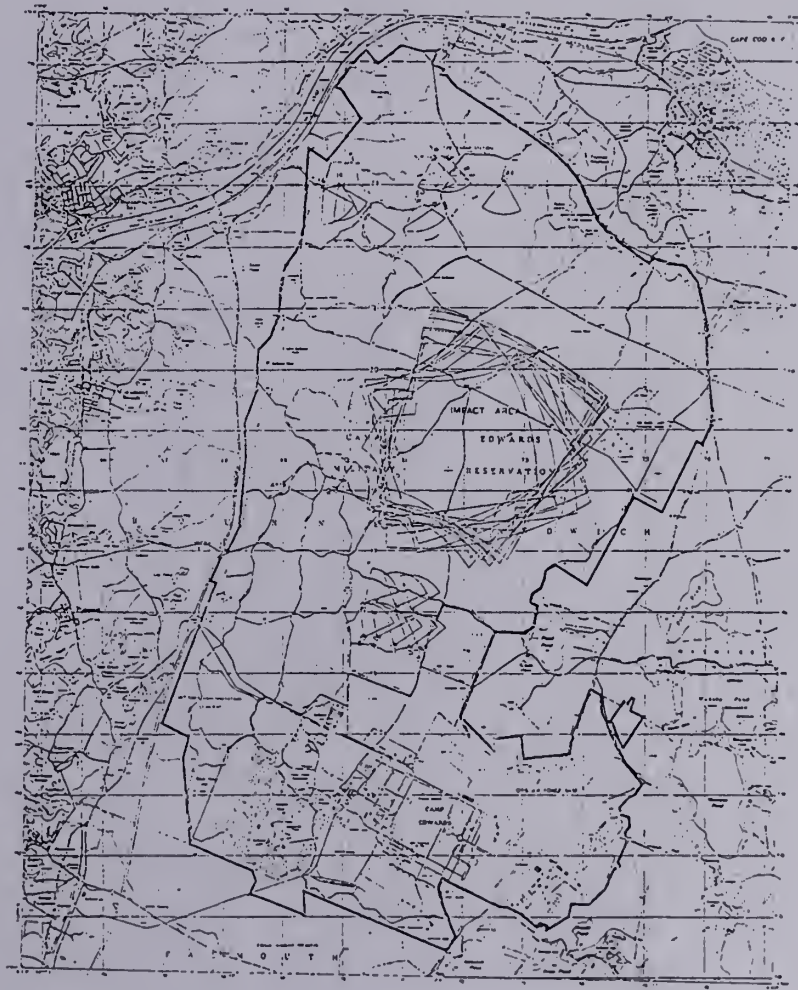
## MAP 5B MORTAR RANGES

Date Prepared: March 1961

James M. Montgomery  
Consulting Engineers, Inc.

MASSACHUSETTS





THE COMMONWEALTH OF MASSACHUSETTS  
MASSACHUSETTS MILITARY RESERVE  
FACILITIES ENGINEERING

MAP 5c  
105mm ARTILLERY RANGES

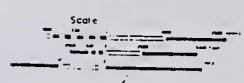
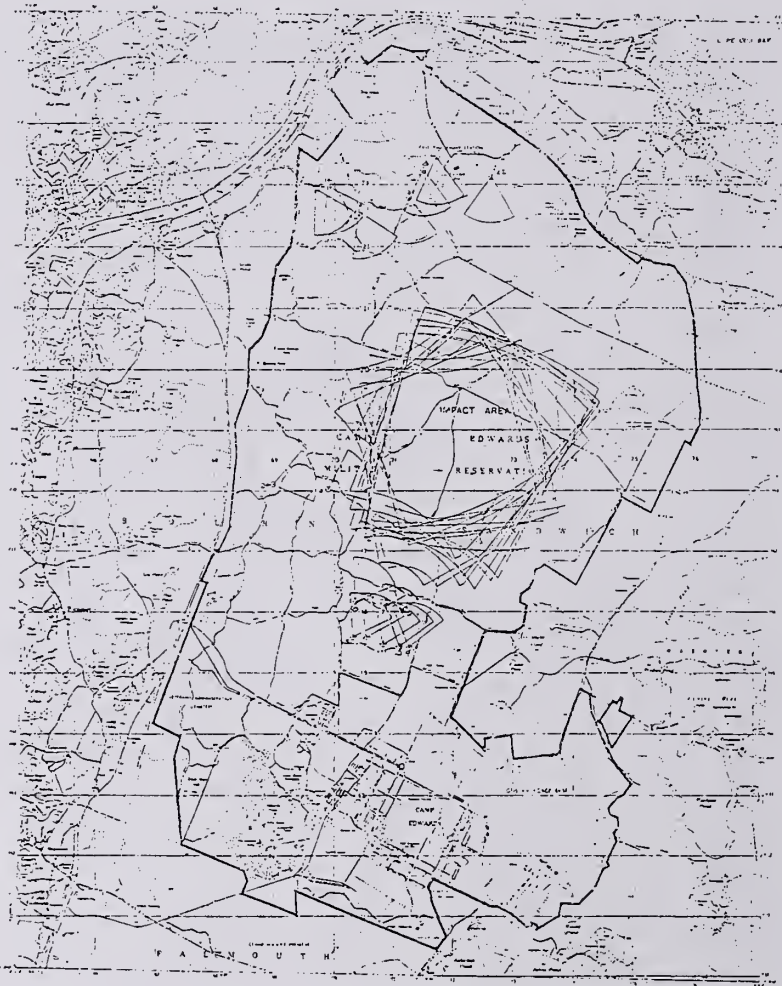
Data Source:  
Massachusetts Army National Guard, December 1961  
Topographic Map, 1:50,000 Scale, Sheet No. 105000000  
Sheet No. 5

Scale 1:50,000 (approx.)

NOTE:  
This map is not to be used  
for firing or military  
purposes. It is for  
information only.

John J. Montgomery  
Consulting Engineer, Inc.

MASSACHUSETTS



THE COMMONWEALTH OF MASSACHUSETTS  
 MASSACHUSETTS MILITARY DIVISION  
 FACILITIES ENGINEERING  
 MAP 5d  
 155mm ARTILLERY RANGES

Data Source:  
 Massachusetts Army National Guard, December 1987  
 Master Plan, Camp Edwards, Bourne, Massachusetts  
 Sheet No. 3

Date Printed: April 1988

NOTE:  
 This map is not to be used  
 for firing or spot  
 purposes. Range data are  
 illustrative only.

James M. Montgomery  
 Consulting Engineers, Inc.  
 Weymouth, Massachusetts







# DRAFT RANGE USE HISTORY REPORT

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## Appendix G. Historical Information on CS-19





# Massachusetts Military Reservation

*Draft*

## CS-19 SUPPLEMENTAL SITE INVESTIGATION WORK PLAN

*November 1996*

*Prepared for:*

**HQ AFCEE/MMR**

**DERA Restoration Division**

**Brooks Air Force Base, TX 78235**

*Prepared by:*

**Jacobs Engineering Group Inc.**

**318 East Inner Road, Otis ANGB, MA 02542**

**Document No.: AFC-J23-35G48400-M1-0001**



## 2.3 CS-19 STUDY AREA HISTORY

The CS-19 Study Area is an approximately 100- by 150-foot area located in the west-central region of the firing range Impact Area. The site is located approximately 2,000 feet north of Succonessett Pond, and 4,000 feet southwest of the intersection of Turpentine Road, Wood Road, and Pocasset-Sandwich Road. Geologically, this area is located on the MPP. The area has been the focus of a 1991-1992 Preliminary Assessment (PA) (ABB Environmental Services, Inc. [ABB-ES] 1992), a 1992 Site Assessment (ANG 1992b) and a 1994 limited-focus groundwater contamination Site Investigation (USACHPPM 1994).

The PA (ABB-ES 1992) included the following:

- a site visit;
- interviews of past and present MMR personnel and other persons who might have knowledge of activities that occurred at study area CS-19; and
- a review of historical aerial photographs.

Findings from the PA supported the hypothesis that CS-19 was historically used as an ordnance disposal site. In particular, PA investigators identified a pit filled with hundreds of spent 2.75-inch rocket motors, 2.75-inch rocket motor assemblies, and aluminum canisters designed to hold the motors. Investigators also identified spent 2.75-inch rocket motors, 60-millimeter mortar illumination round tail assemblies, a spent 155-millimeter leader round shell, and spent blank small arms ammunition on the ground.

The Site Assessment (SA) (ANG 1992b) described geophysical surveys conducted in the study area including magnetometer, terrain conductivity, and ground-penetrating radar (GPR) surveys. The SA also discussed seven test pit excavations conducted with a backhoe to depths of 11 feet below ground surface (bgs). After excavation and sampling were complete, test pits were backfilled and their locations marked with



wooden stakes. The SA identified remains of three former burn pits at the study area. Additionally, test pit excavations uncovered large quantities of buried ordnance debris in the eastern section of the study area and buried piping to the north of the study area at the location of a former observation tower.

The only organic chemical contamination that was detected was in the soil at less than 3 feet bgs. Inorganic chemical contamination was detected at concentrations exceeding established MMR background levels that are very conservative. The explosive compound, HMX, was detected in low concentrations. All chemical contamination identified in the soil was of relatively low concentration and limited extent.

The Site Investigation (USACHPPM 1994) provided a limited-focus investigation of potential groundwater contamination at CS-19. During this investigation four monitoring wells were installed and groundwater was subsequently sampled. Before installing the well, unexploded ordnance (UXO) clearance was performed; however, no "live" UXOs were detected.

Groundwater was encountered at depths of 116 to 117 feet bgs, at elevations of about 67 feet above mean sea level. The groundwater flow direction appears to be westerly, as indicated by water-level measurements. Contamination detected in the groundwater samples includes the explosive compound RDX, chromium, iron, manganese, sodium, acetone, methylene chloride, and bis(2-ethylhexyl) phthalate. The Preliminary Risk Evaluation (USACHPPM 1994) eliminated bis(2-ethylhexyl) phthalate as a contaminant of potential concern because it was detected in the deionized water used in the field sampling. Iron and sodium were also eliminated because they are essential nutrients. Methylene chloride was eliminated because it is a probable laboratory contaminant. Acetone was not eliminated as a probable laboratory contaminant because it was not detected in blank samples.

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# INSTALLATION RESTORATION PROGRAM

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## SITE ASSESSMENT WORK COMPLETION REPORT CHEMICAL SPILL SITE IN IMPACT AREA (STUDY AREA CS-19)

MASSACHUSETTS MILITARY RESERVATION  
CAPE COD, MASSACHUSETTS

FINAL

NOVEMBER 1992



HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM

Oak Ridge, Tennessee 37831-7606

managed by

MARTIN MARIETTA ENERGY SYSTEMS, INC.

for the

U.S. Department of Energy under contract DE-AC05-84OR21400

## 1.0 INTRODUCTION

In 1990, the National Guard Bureau (NGB) initiated an investigation of a potential hazardous waste site in the Camp Edwards Artillery Impact Area at the Massachusetts Military Reservation (MMR), as a result of information provided to the Massachusetts Department of Environmental Protection (MADEP) by an anonymous source (NGB, 1990). This source indicated that activities were observed in the late 1960s within the Impact Area which might have involved the disposal of hazardous materials. This site had not previously been identified as a historical hazardous waste area in the MMR Records Searches (Metcalf and Eddy, Inc., 1983; E.C. Jordan, 1986). A site walkover subsequently was conducted by the NGB and MADEP on August 30, 1990, with escort provided by the Camp Edwards Range Control. Soil at the site was described as unvegetated, lightly stained, and damp. Scattered debris including 55-gallon drum covers and retaining rings, miscellaneous pieces of metal pipe, and ordnance debris were observed. Based on the results of the walkover, the NGB assigned this site as Study Area Chemical Spill No. 19 (CS-19) and decided that preliminary assessment (PA) and field sampling activities were warranted.

The scope of Site Assessment (SA) and PA activities to be conducted at Study Area CS-19 were defined initially in the Phase I Sump Removal Action Program Activities and Study Area CS-19 SA Sampling and Analysis Plan (SAP) (ABB Environmental Services, Inc., [ABB-ES] 1991). When the SAP was prepared for Study Area CS-19, little was known about the area except that the site might have been used as an unrecorded disposal site. The PA of Study Area CS-19 was begun in the fall of 1991 to identify information which might relate to the history of Study Area CS-19. The PA included: 1) a site visit; 2) interviews of past and present MMR personnel and other persons who might have knowledge of activities that occurred at Study Area CS-19; 3) review of available aerial photographs; and 4) analysis of all information obtained. Results of the PA have previously been reported (ABB-ES, 1992).

Based on the results of the PA (see Appendix A), the SA was designed to determine the nature of activities that could have occurred and assess potential contamination in the surface and shallow soils. The results of the SA are presented in this document.

**Study Area Description.** MMR is located on Cape Cod, Massachusetts (Figure 1-1). Study Area CS-19 is located in the Impact Area of Camp Edwards, approximately



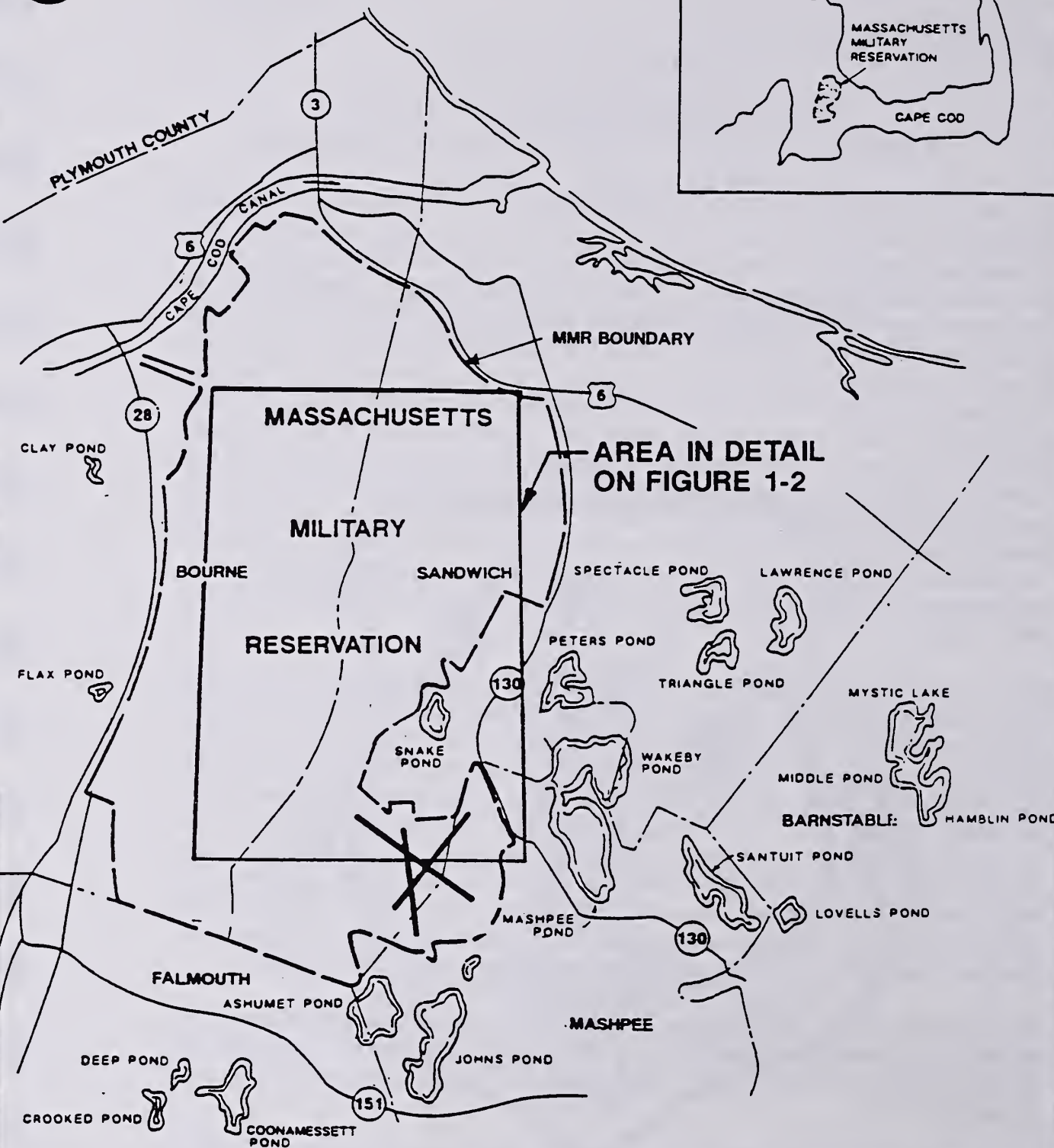
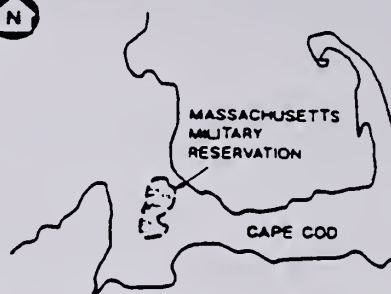


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INSTALLATION RESTORATION PROGRAM  
MASSACHUSETTS MILITARY RESERVATION

SITE LOCATION MAP

STUDY AREA  
CS-19 SITE  
ASSESSMENT  
REPORT

FIGURE 1-1



## SECTION 1

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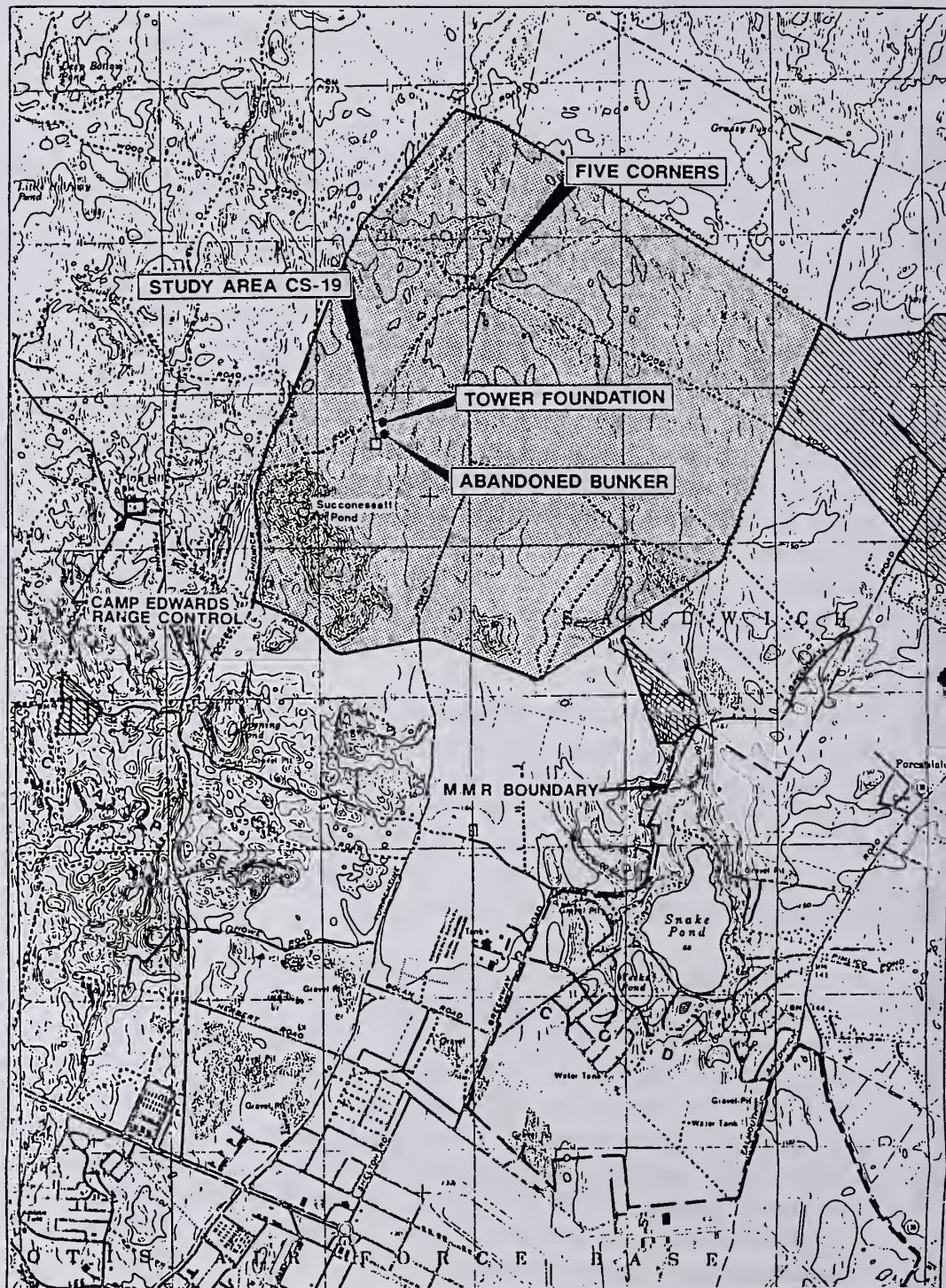
2,000 feet north of Succonessett Pond, and 4,000 feet southwest of the intersection of Turpentine Road, Wood Road, and Pocasset Sandwich Road (known as Five Corners) (Figure 1-2). Study Area CS-19 consists of an unvegetated knoll, approximately 0.32 acres in size (Figure 1-3). Because the study area is located within the Impact Area, there is the potential for unexploded ordnance (UXO) to be on site. UXO was not observed on the ground surface of the study area during the site visit on September 12 and 13, 1991; however, spent 2.75-inch rocket motors, 60-millimeter mortar illumination round tail assemblies, spent 155-millimeter leader round shells, and blank small arms ammunition were observed on the ground. Rusted 55-gallon drum lids and rings and unidentified scrap metal and piping were also observed on the ground at the study area. On the western edge of the site, next to but not within the unvegetated part of the study area, a pit filled with 2.75-inch rocket motor assemblies and aluminum canisters designed to hold the motors was identified. An abandoned concrete bunker (i.e., observation post) and an unidentified concrete foundation that are believed to be the location of a tower are present approximately 150 yards northeast of the study area (see Figure 1-2).

**Disposal Site Identification, Evaluation, and Hazard Assessment.** The PA could not identify any records of disposal or site history for Study Area CS-19. Because of the period of use for waste disposal, the PA focused on identifying U.S. Air Force (USAF)-related activities that could have used Study Area CS-19 for waste disposal. Review of available aerial photographs showed that activities at Study Area CS-19 were initiated before 1970. During this period, U.S. Army activities in the range area of Camp Edwards were of caretaker status.

In an interview, a witness to activities at Study Area CS-19 recalled potential disposal of waste materials in a pit approximately six feet deep, 30 to 40 feet long, and 20 to 30 feet wide. The waste disposal activity reportedly occurred in the fall of 1967 and winter of 1968. During the waste disposal activity, white dust or smoke was observed rising from the pit, but no odors were noted. Chemicals speculated to have been disposed of at Study Area CS-19 included red fuming nitric acid, Aerozine-50, Jet Fuel-4 (JP-4), explosives or solid propellants, herbicides, hydraulic system fluids, oils, and waste solvents (ABB-ES, 1992). It was also speculated that the study area contains buried UXO and rocket motor bodies from range firing and possible test range ordnance disposal activities.

Further information on Study Area CS-19 was obtained through interviews and additional file reviews conducted during SA field activities. This new information,





#### SCALE

0 1000 2000 3000 4000 5000 6000 7000 FEET

#### NOTE:

BASE MAP TAKEN FROM U.S.G.S. TOPOGRAPHIC MAP  
FOR THE POCASSET QUADRANGLE (7.5-MINUTE SERIES)  
1972; PHOTO REVISED 1979



#### LEGEND



-  OFF LIMITS AREA
-  IMPACT AREA



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STUDY AREA  
CS-19 SITE LOCATION MAP

STUDY AREA  
CS-19 SITE  
ASSESSMENT  
REPORT

FIGURE 1-2



TO POCASSET -  
SANDWICH ROAD

VEHICLE ACCESS

**LEGEND**



METAL DEBRIS ON SURFACE



BRUSH LINE



TOPOGRAPHIC DEPRESSION

APPROXIMATE SCALE IN FEET

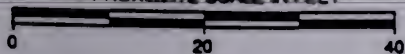


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LAYOUT OF  
STUDY AREA CS-19

STUDY AREA  
CS-19 SITE  
ASSESSMENT  
REPORT

**FIGURE 1-3**



## SECTION 1

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used during the field program to focus exploration activities, consisted of the following:

- The configuration of depressions and stockpiles of empty 2.75-inch rocket motors at Study Area CS-19 are interpreted to be the location of burn pits and waste piles from standard ordnance disposal practices of the 1950s and 1960s (Mr. Stuart Eanes, personal communication, 1992). During these disposals, 2.75-inch rocket motors were placed in a shallow excavation in a herring-bone pattern, doused with a flammable substance such as fuel oil, and ignited. Larger rocket motors were placed vertical with the nose down, buried two-thirds into the ground, and then ignited. Often, packing materials (i.e., treated wood crates, metal lined boxes, and strapping) would be similarly disposed of.
- Information relating to possible Study Area CS-19 activity was obtained from other studies at propellant burning grounds and weapons production facilities (E. C. Jordan Co., 1990). In these studies, site contaminants in soils included lead, 2,4-dinitrotoluene, (2,4-DNT), 2,6-DNT, cyclotetramethylenetetranitramine (HMX), diethylphthalate, di-n-octylphthalate, bis(2-ethylhexyl)phthalate, trinitrotoluene (TNT), and diphenylamine.
- 2.75-inch rockets were a common munition used in the 1967-1969 time frame in U.S. Marine, Army, Air Force, and Navy aircraft. The 2.75-inch rockets did not originate at MMR but would have been from other aircraft units that used the impact area ranges (Mr. Ralph Turner, personal communication, 1992; see Appendix B). "Dud" rockets were removed from aircraft landing at MMR and subsequently destroyed and disposed of in the impact area at one of several locations.
- The tower foundation between Study Area CS-19 and the bunker to the north was used as a site to test munitions in the 1950s. Approximately 20 munitions tests were conducted with explosive charges as large as 300 pounds (Mr. Bob Clark, personal communication, 1992; see Appendix B). Lengths of scrap pipe and cinder block debris were generated by the experiments. These



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SECTION 1

materials can be seen along an overgrown path from the bunker toward Study Area CS-19.

This new information, in particular, supported the hypothesis that Study Area CS-19 was historically used as an ordnance disposal site. As such, contaminants resulting from ordnance and fuels were suspected. After the PA was prepared for Study Area CS-19 (ABB-ES, 1992), the sampling and analytical program was redesigned to better address the potential for UXO at the site, and also to redirect activities to address potential disposal activities that occurred in on-site pits or trenches. The two discrete sampling events were replaced with a geophysical survey (Phase I) followed by a single soil sampling event (Phase II).

Meteorology, hydrology, geology, critical habitats, and other information pertaining to MMR are presented in the Study Area CS-19 PA (ABB-ES, 1992).

area of the site, a pit filled with 2.75-inch rocket motor assemblies and aluminum canisters designed to hold the rocket motors was identified.

#### **4.2 STUDY AREA GEOLOGY AND HYDROGEOLOGY**

The surface elevation of Study Area CS-19 is approximately 190 feet above mean sea level. The surface of the study area is irregular and cratered, and surface soils consist of well graded gravelly sand with some cobbles and silt. Surface soils appear to have some black staining. Craters observed contained silty mud with deer tracks, indicating that precipitation may pond in the craters after rain events, which may then be used by wildlife for water supply.

Study Area CS-19 is located on the MPP. The depth to groundwater beneath the study area is estimated to be 130 feet. Groundwater likely flows from the study area west to west-northwest toward Route 28 in Bourne.

#### **4.3 DISPOSAL SITE IDENTIFICATION, EVALUATION, AND HAZARD ASSESSMENT**

There are no known records of disposal or site history for Study Area CS-19. This PA is based on interviews conducted with six people on September 12 and 13, 1991 (see Addendum A). Because of the period of use for waste disposal, the PA focused on identifying USAF-related activities that may have used Study Area CS-19 for alleged waste disposal. Review of available aerial photographs showed that activities at Study Area CS-19 occurred before 1970. At the time that activities apparently occurred at Study Area CS-19, ARNG activities in the range area of Camp Edwards were at caretaker status; therefore, it is unlikely the potential chemicals disposed of in Study Area CS-19 originated from ARNG activities.

Based on descriptions of Study Area CS-19 and Boeing Michigan Aeronautical Research Center (BOMARC) site activities obtained from interviews, and information identified in the MMR area of contamination (AOC) chemical spill (CS) No. 10 remedial investigation (RI) and Task 6 Records Search reports (E.C. Jordan Co., 1986 and 1991), the following discussion is an interpretation of activities that may have occurred at Study Area CS-19 and identification of potential site contaminants.

Six past or present MMR personnel or other persons were interviewed to obtain information concerning possible waste disposal activities that may have occurred at Study Area CS-19. Interviews were conducted by ABB-ES personnel. In one interview in which key information was obtained, an interviewee asked to remain anonymous.

Personnel Interview - Dan Cullity and Anonymous Source. Study Area CS-19 was originally brought to the attention of the ANG and regulatory agencies in 1990 by Dan Cullity, a town of Sandwich Technical Environmental Affairs Committee member, who recalled observations of alleged disposal activities from an anonymous source in 1990. ABB-ES was able to interview the anonymous source of information, who observed activities in the Impact Area, including alleged dumping at Study Area CS-19, as described in the following paragraph.

The source used to ride motorcycles on Camp Edwards as a youth, as did Mr. Cullity. The source frequented the Impact Area; in particular, the bunker located northeast of Study Area CS-19. In the fall of 1967 and winter of 1969, the source observed activities at Study Area CS-19. The first time that alleged dumping occurred, the source was at the bunker, when he observed a single tanker truck drive to the study area from the east (i.e., Turpentine Road). While hidden from view at the bunker, the source observed two or three people, possibly in protective clothing, back the truck up to the Study Area CS-19 location, conduct an unobservable activity, remain at a distance from the truck for a short period, then retrieve the truck and drive away toward the east. The tank on the back of the truck may have been unpainted stainless steel. No other vehicles were visible. During the time the truck was at Study Area CS-19 and personnel were at a distance, white dust or smoke was observed, but no odors were smelled.

After the truck and personnel left the site, the source visited the Study Area CS-19 location. What the source observed was a pit, approximately 6 feet deep, 30 to 40 feet long (north to south), and 20 to 30 feet wide (east to west). On the border of the pit was some oily soil staining, corroded scrap metal, and spent 2.75-inch rocket motors. In the middle of the pit were two or more 3- to 4-inch-diameter threaded pipes sticking up vertically from the ground. Around the base of the pipes was a small amount of brown, thin-viscosity liquid that frothed or may have been bubbling, possibly in reaction with soil. No odors were noted. No drum rings or lids were observed. The source observed the same tanker truck conducting the same



## ADDENDUM

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operation at the pit several times. The source did not observe activities at Study Area CS-19 after 1968.

Personnel Interview - Dixie Dugan. Dixie Dugan works with the 102<sup>nd</sup> Civil Engineering of the ANG, and has been a historical resource for other preliminary assessments by ABB-ES at MMR, particularly for former ANG and USAF activities. Mr. Dugan related that he has no knowledge of use of the Impact Area for potential disposal activities; however, because of the pre-1970 time frame and the secure nature of USAF activities related to the BOMARC facility (i.e., the USAF operation nearest the study area), it is possible that BOMARC was a source. Mr. Dugan provided the name of Tom Howarth of the DOD police as a potential source of BOMARC information.

Personnel Interview - Tom Howarth. Mr. Howarth currently works for the DOD police at MMR. Mr. Howarth was an NCO clerk at the BOMARC facility at MMR from January 1970 to May 1972. Mr. Howarth was not knowledgeable of BOMARC waste handling activities that may be directly related to Study Area CS-19. However, it was described that fuel transport vehicles were dark colored, possibly olive drab (in this period, only JP-4 was handled at BOMARC). Fuel-handling personnel wore white coverall-type clothing and, when working, wore hoods with a single filter cartridge on one side. Mr. Howarth worked in what is currently identified on MMR grid utility maps as Building 4602, and recalls the ramjet test cell in the building. Boeing was not present at the facility at this time.

Mr. Howarth remembered making two interesting trips during his work at the site: (1) a trip to a Saco, Maine, USAF laboratory (in the fall of 1971) to deliver priority samples for analysis due to a fuel contamination problem (he did not recall the type of fuel, but it is likely to have been JP-4 because he drove to Maine in a car with the fuel samples in an unlabeled cardboard box); and (2) a trip to the McGuire USAF BOMARC facility to drop off a priority equipment shipment (equipment unknown). Mr. Howarth provided the name of Dick White as a possible source of additional information from this period.

Personnel Interview - Dick White. Mr. White currently works for the Sandwich Police Department. Mr. White was the First Sergeant at the BOMARC facility from 1969 to 1971. Mr. White related that BOMARC missiles were converted from the



RFNA/Aerozine-50 fuel system to solid fuel boosters in 1967 and 1968. BOMARC missiles used solid-fuel rocket boosters from 1969 to site closure. Mr. White worked in what is currently known as Building 4601. He did not have knowledge of waste disposal practices that might be related to Study Area CS-19. Mr. White provided the name of Phillip Spofford as a possible source of additional information from this period.

Personnel Interview - Phillip Spofford. Mr. Spofford is retired and lives in Sandwich, Massachusetts. Mr. Spofford worked at the BOMARC site from 1958 to 1960 in what is known as Buildings 4606 and 4618. He was responsible for manufacture of nitrogen gas to cap RFNA storage vessels, and assisted in maintenance of high pressure air compressors. Mr. Spofford recalled one RFNA spill event in 1958 in the missile silo area of the BOMARC facility that resulted in evacuation of the facility until fumes had dissipated. He believed that during his work at the site that carbon tetrachloride was used to clean parts. Mr. Spofford could not recall specific waste disposal activities that might be related to Study Area CS-19.





**ABIB** ABD Environmental  
Services, Inc.  
A B I B A B I B A B I B

INSTALLATION RESTORATION PROGRAM  
MASSACHUSETTS MILITARY RESERVATION

STUDY AREA CS-19

STUDY AREA  
CS-19  
PRELIMINARY  
ASSESSMENT

FIGURE 4-2



MEMORANDUM

PROJECT NO.: 6984-06 DATE: 6/16/92  
CLIENT: HAZWRAP/MMR  
PROJECT DESCRIPTION: MMR - CS-19 Site Assessment  
TO: B. McGirr / D. Allen  
FROM: 1x/sen Bretton  
SUBJECT: EOD waste disposal practices in RAMPB AREA 4 + MMR  
• Communication between IRP OFFICE and RALPH TURNER

Enclosed is a Fax transmittal received from Dan Santos concerning waste disposal practices in the Impact area of MMR. The information provided by Mr. Turner of the 102 CAMS mentions supports the findings of the CS-19 Site Assessment.

DISTRIBUTION:

ABB

B. McGirr

D. Allen

M. VOISINE File - 10.15.1 for project # 6984-06

**COMMENTS:**



5/21/92

Dan:

I called and spoke to Ralph Turner (X4696) of 102 CAMS Munitions on Gerry F.'s advice. He used to work (on active duty) at Goat Hill in EOD during the 1967-1969 time frame. He says that munitions were disposed of in the impact area by the Marines, Army, Air Force, and Navy. When I told him of what we found at CS-19 he said that the tubes were 2.75 inch rocket tubes that were very common on all kinds of military aircraft during the late 60's. He also said that the 2.75 inch rockets did not originate on Otis but would of been from other aircraft of other units that had used the impact area ranges. When these aircraft would land, any "dud" rockets were taken from the planes by EOD. The rockets were subsequently destroyed and disposed of within the impact area. He also told me that he knows of several "sanctioned" areas of destruction and disposal that he could show us. He also feels that there are numerous unofficial sites also, and CS-19 is most likely one of these.

## INTERVIEW WITH BOB CLARK

Bob Clark has been at MMR since 1952-53, working at Test ranges. Experiments were conducted south of bunker in the 1950's, involving approximately 20 tests of aerial explosives. Bunker built originally by Camp Edwards. Maximum charges of aerial explosives were 300 lbs.

Mr. Clark noted that as far as he could remember, the bunker area has been used by National Fireworks, National Northern, American Potash, Atlantic Research, AVCO, and Textron.

2.75 inch rockets were used at MMR in the early 1950's. Few 2.75 inch rockets were fired off the J-5 range. Testing of Munitions. No idea about 30mm shell found onsite.

From description, Mr. Clark was not specifically aware of any activities that occurred at Study Area CS-19. He noted that a military operation standard procedure would be to burn the rockets with fuel oil in a pile. Mr. Clark stated that the site changed appearance after his tests were conducted. His tests were probably conducted in 1954 to 1956.

- Interview attended by Maj. Giarard, S. Fleming.
- Interview occurred on January 16, 1992 at nine o'clock in the morning. The statements were written into the field log book by Brian Butler.







# DRAFT RANGE USE HISTORY REPORT

■ ■ ■ ■ ■

## Appendix H. Summary of Textron's Recent Activities at J-3 Range



# TEXTRON SYSTEMS CORPORATION

## TEXTRON CAPE OPERATIONS

The Camp Edwards Environmental Affairs Office has requested Textron Systems Corporation (TSC) to provide information about its Textron Cape Operations (TCO) on the J3 Range portion of the Massachusetts Military Reservation (MMR). The information is provided to the Camp Edwards Environmental Affairs Office in response to a request for information from the United States Environmental Protection Agency (USEPA).

This letter will provide answers to the following questions:

- What arrangements does TSC have with Camp Edwards to use the J3 Range?
- What other sources does TSC have at its disposal for testing products under development for the U.S. Army and U.S. Air Force?
- What is the nature and frequency of high explosive "warhead" testing on the J3 Range?
- What other types of activities are performed on the J3 Range?
- Is TSC complying with Camp Edwards orders to stop all Range firing?
- Has TSC ever done soil sampling on the J3 Range?

### What arrangements does TSC have with Camp Edwards to use the J3 Range?

The first formal Lease between the Secretary of the Army and Avco Corporation is dated 1 June 1978. The Lease, DACA51-1-78-469 was for a term of ten (10) years. Avco Corporation was purchased by Textron Incorporated in 1985. The Lease was renewed on 1 February 1989. The renewed Lease, DACA33-1-89-43 was for a term of five (5) years. The current arrangement is a License to use the J3 Range and became effective 1 February 1994. The License, DACA51-3-94-46 has a term of five (5) years. All Leases/Licenses have been administered by the Army Corps of Engineers.

### What other sources does TSC have at its disposal for testing products under development for the U.S. Army and U.S. Air Force?

Currently TSC does not have other facilities for conducting range firing test activities of the type performed on the J3 Range. TSC is currently conducting a search of available facilities around the country.

Post-it® Fax Note	7671	Date	6/23/97	Page	8
To	LT. COL R. MURPHY	From	JIM TANIN		
Co./Dept.		Co.	TEXTRON SYSTEMS		
Phone #		Phone #	(508) 657-3691		
Fax #	(508) 968-5818	Fax #	(508) 657-2522		

### **What is the nature and frequency of high explosive "warhead" testing on the J3 Range?**

TSC is under contract to the U.S. Army and the U.S. Air Force to develop Anti Armor Smart Munitions. The primary part of the munition is the explosive "Skeet". A Skeet contains about two (2) pounds of explosive, either Octol or a variety of plastic bonded explosives (PBE). The constituents of OCTOL and PBE are shown in Table 1. A typical decomposition of OCTOL and a PBE, LX-14 is shown in Table 2. The Skeet is made from steel and is 5 inches in diameter by 3.75 inches long. The Skeet contains an infrared sensor for detecting hot targets and a electronics board for controlling the munition functions. When the Skeet is fired, a high energy projectile is formed which is capable of piercing armour. The projectile is made of copper or tantalum and does not contain any explosives. See photo diagram of the Skeet.

Skeets are loaded with explosives at the J3 Range and then test fired on the Range. The projectile is fired horizontally, a distance of approximately 200 feet, into an armour plate. During the firing test, x-ray pictures are taken of the projectile to study its flight characteristics. In 1996, an average of 1.3 skeets were fired per week with a maximum of 4 per week.

### **What other types of activities are performed on the J3 Range?**

There are three types of non-high explosive tests currently conducted on the J-3 Range. These tests involve launching a projectile that falls into the general category of range firing. They are:

#### **TOWER TESTS**

In this test, an inert projectile, weighing approximately 8 lb., containing a small black powder spotting charge is launched from our 80 ft. tower into a net located approximately 300 feet away. The spotting charge functions while the projectile is in flight. The projectile is launched by spinning it on an electrically driven spin fixture in the tower and releasing it by firing an explosive bolt. A completely inert projectile, with no spotting charge, is simultaneously released to fly in the opposite direction. Both projectiles are recovered at the end of the test.

During 1996, 67 Tower Tests were conducted on the J3 Range. These tests are generally scheduled to occur weekly and are lot acceptance tests required to support the production of a munitions being manufactured under contract to the U.S. Air Force.

#### **GROUND LAUNCH TESTS**

In these tests a similar projectile is launched from a launch tube on the ground, propelled by a gas generator containing approximately 7 grams of propellant. In most of these tests the projectile carries on board test instrumentation and no spotting charge is required. In some tests a small black powder spotting charge similar to that used in tower test is fired while the projectile is in flight. The projectile travels approximately 470 feet down range with a maximum ordinate of approximately 80 feet. The projectile may be caught in a net, but in any event is recovered after the test.



During 1996, 58 Ground Launch Tests were conducted. These tests are conducted under contract to the U.S. Army.

#### **ROCKET MOTOR GROUND LAUNCH TEST**

In these tests, a small rocket motor with a burn time of approximately one second, vertically launches an inert test vehicle approximately 120 ft. above ground level while also imparting a spinning motion. The test item is photographed in flight, falls to the ground, and is recovered after the test.

No Rocket Motor Ground Launch Tests were conducted in 1996. Two of these tests were conducted in 1995. These tests are conducted under contract to the U.S. Air Force.

**HAZARD CLASSIFICATION DATA**  
Hazard classification data for all ordnance components in the above non high explosive tests are shown in Table 3.

**Is TSC complying with Camp Edwards orders to stop all Range firing.**

All warhead test firing on the J3 Range is controlled by the Camp Edwards, Range Control Officer. TSC has been directed not to test fire and has ceased all range firing.

**Has TSC ever done soil sampling on the J3 Range?**

TSC has not done any soil samples on the J3 Range proper. Since the projectiles from the skeets do not impact the soil on the range, it has not been determined necessary. In 1992, in the course of removing all fuel oil underground storage tanks (UST), TSC had soil samples taken near the UST's. All samples were below the method detection limit (1 ppm) for total petroleum hydrocarbons. A copy of Certified Engineering & Testing Company test results is attached hereto.

TABLE 1

## COMPOSITION OF VARIOUS HIGH EXPLOSIVE MATERIALS

Material	Density	HMX	TNT	BDNPA (bis2,2-dinitropropyl acetal)	BDNF (bis2,2-dinitropropyl formal)	CAB (Cellulose Acetate Butyrate)	Copolymer (Vinylidene fluoride & hexafluoropropyl)	Polycarbonate Elastomer (Hytamp 4464)	DI-(2-ethoxyethyl) Adipate	Estane 6702-F1	DOA	TOTAL
LX-14-0	1.8	96.5%								4.5%		100.0%
OCTOL	1.8	75.0%	25.0%									100.0%
PAX2-A	1.8	85.0%		4.5%	4.5%	6.0%						100.0%
PBXN-6		95.0%					5.0%					100.0%
PBXN-9	1.7	82.0%						2.0%	6.0%			100.0%
PBXW-11	1.8	96.3%						0.8%			2.9%	100.0%

TABLE 2

## OCTOL EXPLOSIVE

The Chemical Equation is:  $C1.78+H2.58+N2.36+O2.69$  (OCTOL)  $\longrightarrow 1.29H_2O+1.18N_2+0.70CO_2+1.08O$

CONSTITUENTS OF SOLID OCTOL EXPLOSIVE

ELEMENTS	MOLE	ATOMIC WT	GRAMS	1 LB of OCTOL	
				(GRAMS)	LBS.
Carbon	1.78	12	21.36	96.88896	0.2136
Hydrogen	2.58	1	2.58	11.70288	0.0258
Nitrogen	2.36	14	33.04	149.86944	0.3304
Oxygen	2.69	16	43.04	195.22944	0.4304
			100.02	453.69072	1.0002

CONSTITUENTS UPON EXPLOSION

GASES	MOLE	ATOMIC WT	GRAMS	1 LB of OCTOL	
				(GRAMS)	LBS.
H <sub>2</sub> O	1.29	18	23.22	105.32592	0.2322
N <sub>2</sub>	1.18	28	33.04	149.86944	0.3304
CO <sub>2</sub>	0.70	44	30.80	139.70880	0.3080
O	1.08	12	12.96	58.78856	0.1296
			100.02	453.69072	1.0002

## LX-14 PLASTIC BONDED EXPLOSIVE

The Chemical Equation is:  $C1.52+H2.92+N2.59+O2.66$  (LX 14)  $\longrightarrow 1.48H_2O+1.295N_2+0.60CO_2+0.92O$

CONSTITUENTS OF SOLID LX-14 EXPLOSIVE

ELEMENTS	MOLE	ATOMIC WT	GRAMS	X	1 kilo of LX-14	
					(GRAMS)	1 Lbm of LX-14 (LBS)
Carbon	1.52	12	18.24	0.1824	182.4	0.1824
Hydrogen	2.92	1	2.92	0.0292	29.2	0.0292
Nitrogen	2.59	14	36.26	0.3627	362.7	0.3627
Oxygen	2.66	16	42.56	0.4257	425.7	0.4257
			99.98	1.0000	1000.0	1.0000

CONSTITUENTS UPON EXPLOSION

GASES	MOLE	ATOMIC WT	GRAMS	X	1 kilo of LX-14	
					(GRAMS)	1 Lbm of LX-14 (LBS)
H <sub>2</sub> O	1.480	18	26.64	0.22629	226.9	0.22629
N <sub>2</sub>	1.295	28	36.26	0.36270	362.7	0.3627
CO <sub>2</sub>	0.600	44	26.40	0.26400	264.0	0.2640
C	0.920	12	11.04	0.11040	110.4	0.1104
			99.98	0.98339	1000.0	1.0000

Prepared by James J. Tanin 4/3/97



TABLE 3

## HAZARDOUS COMPONENTS LIST

### NON-HIGH EXPLOSIVE MATERIALS

TOWER TESTS		EXPLOSIVE	QUANTITY PER TEST	PRELIMINARY D.O.T. CLASS
DESCRIPTION	EXPLOSIVE MATERIAL	WEIGHT (Mg)		
Explosive Bolt	Zinc Potassium Perchlorate	25	2	1.4S
	Lead Azide	75		
	RDX	150		
Thermal Battery	NEI-11 (Ignitor)	25	1	Unreg. Material
	Boron/Calcium Chromate	21		
	Zinc Potassium Perchlorate	4		
Precision Initiation Coupler	FFFg Black Powder	750	1	Unreg. Material
Warhead Detonator	Lead Azide	90	2	1.4B
	PETN	85		
GROUND LAUNCH TESTS		EXPLOSIVE	QUANTITY PER TEST	PRELIMINARY D.O.T. CLASS
DESCRIPTION	EXPLOSIVE MATERIAL	WEIGHT (Mg)		
Gas Generator Assy.	Booster: $\text{BkNO}_3$	330	1	1.4C
	VPG-101	290		
	M-36 Propellant	6,550		
Initiator Assy - SDI Squid	Zinc Potassium Perchlorate	130	1	1.4G
	Titanium Hydride	Incl.		
Thermal Battery	NEI-11 (Ignitor)	25	1	Unreg. Material
	Boron/Calcium Chromate	21		
	Zinc Potassium Perchlorate	4		
Piston Actuator	Barium Styphnate	18	1	
ROCKET MOTOR TESTS		EXPLOSIVE	QUANTITY PER TEST	PRELIMINARY D.O.T. CLASS
DESCRIPTION	EXPLOSIVE MATERIAL	WEIGHT (Mg)		
Rocket Motor w/ Initiator	Ap with HTP Binder	966,000	1	1.3C
	Ignitor $\text{BkNO}_3$	4,000		
	Initiator: Zirconium	60		
	Titanium Hydride	88		

Prepared by James J. Tanin 4/3/97



## CERTIFIED ENGINEERING AND TESTING COMPANY, INC.

Client: NORTHEAST TANK SERVICES  
Project No:

Sample Series: 91-06-103

Sample: 91-06-103.01 Matrix: SOIL Date Sampled: 6/15/91  
Sample Location: J-3-3

Sample Description: ONE LITER GLASS CONTAINER OF SOIL

<u>Chemical Analysis</u>	<u>Result</u>	<u>Detection Limit</u>	<u>Date Analyzed</u>	<u>Method</u>
TOTAL PETROLEUM HYDROCARBONS (MG/KG) BMDL		1	7/8/91	418.1
Analyst: LEHMAN, TRACIE				

Sample: 91-06-103.02 Matrix: SOIL Date Sampled: 6/19/91  
Sample Location: J-3-6

Sample Description: ONE LITER GLASS CONTAINER OF SOIL

<u>Chemical Analysis</u>	<u>Result</u>	<u>Detection Limit</u>	<u>Date Analyzed</u>	<u>Method</u>
TOTAL PETROLEUM HYDROCARBONS (MG/KG) BMDL		1	7/8/91	418.1
Analyst: LEHMAN, TRACIE				

Sample: 91-06-103.03 Matrix: SOIL Date Sampled: 6/19/91  
Sample Location: J-3-7

Sample Description: ONE LITER GLASS CONTAINER OF SOIL

<u>Chemical Analysis</u>	<u>Result</u>	<u>Detection Limit</u>	<u>Date Analyzed</u>	<u>Method</u>
TOTAL PETROLEUM HYDROCARBONS (MG/KG) BMDL		1	7/8/91	418.1
Analyst: LEHMAN, TRACIE				

## COMMENTS:

BMDL denotes Below Method Detection Limit.

# TEXTRON SYSTEMS CORPORATION

## EXPLOSIVE SKEET MUNITION

ELECTRONICS BOARD

